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Why Unions Reduce Wage Inequality, I: A Theory of Domino Effects

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Why Unions Reduce Wage Inequality, I:
A Theory of Domino Effects*

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Abstract

Numerous empirical studies show that unions reduce wage differences. I demonstrate that the motive may be a mix of fairness and strategy, maximizing the use of union bargaining power in the presence of efficiency wages. Relying on employers to voluntarily increase higher wages, to protect efficiency-enhancing wage-differences, unions can focus on increasing the lowest wages without sacrificing higher wages much. In fact, if these "domino effects" are strong enough, an egalitarian wage policy may even increase the median wage.

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1 Introduction

A large empirical literature suggests that unions increase wages and reduce wage differences. They reduce wage differences associated with skills, education and tenure, both between and within firms and plants.[1] Since unions primarily raise the lower tail of the wage distribution,[2] the unions' egalitarian preferences appear to reach far beyond the median member's immediate self interest.

The Swedish Trade Union Confederation ("LO") asserts that their motive for favoring their least productive members is partly a matter of fairness but partly also a matter of strategy:

> "Even if only a few people are affected directly, increasing the lowest wages is absolutely decisive for the wage level of the entire group."[3]

A union report explains that increasing the lowest wages causes a *domino effect*. If the unions manage to "push the bottom," they can rely on the employers to increase the wages of employees who have ended up too close to the new lowest wage. Such domino effects subsequently propagate through the entire wage distribution.[4]

The Swedish Employers' Confederation oppose increasing the lowest wages.[5] They argue that increasing the lowest wages increases the total wage cost by more than the direct cost. If the lowest wages are increased, the employers have to increase wages higher up in the distribution. The purpose is to restore wage differences, to maintain worker incentives and firm productivity.[6]

The logic of the domino argument thus remains obscure. It is not clear why the unions succeed in increasing the lowest wages by much, given that the employers are aware of the domino effects and resist increasing the lowest wages in proportion to the total increase in wage cost. It is also not clear why the median workers would gain more from increasing the wages at the bottom, relying on the domino effects, than from focusing the union's bargaining power on their own wages directly. This paper provides answers to these questions.

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[1] The exact numbers depend on the country, the time period and the methodology used. See reviews by Freeman and Medoff (1984), Kaufaman (2002), Blanchflower and Bryson (2003) and Card, Lemieux and Ridell (2004). Recent studies, emphasizing causality, use a regression discontinuity design based on union certification elections and compare the outcomes in establishments where unions barely won with those where unions barely lost. See DiNardo and Lee (2004), Lee and Mas (2009) and Frandsen (2011).

[2] This feature was first noted by Freeman (1980). For a recent study based on a regression discontinuity design, see Frandsen (2011).

[3] Landsorganisationen (2011); Kommunal (2003).

[4] Kommunal (2004).

[5] The Swedish Employers' Confederation lists its opposition to increasing the lowest wages first among its five top priorities in the wage negotiations (Svenskt Näringsliv, 2012).

[6] Meidner (1974); Elvander (1988).

The main results explained The key to the domino argument is that wage differences enhance firm productivity. A firm may increase its productivity by offering a wage premium e.g. to those who invest in more education or to those who volunteer for jobs with less desirable attributes e.g. in terms of location, safety, and cleanliness.[7] If unions raise these wages by way of negotiations, employers need not offer any premium for efficiency reasons. Union bargaining power is wasted.

It may then be better for the union majority to use their collective bargaining power primarily to raise the lowest wages. One way would be to elect a leadership with pronounced preferences for equal wages. Higher wages at the bottom subsequently spill over into higher wages also for those higher up in the wage distribution. These pay increases for the better paid workers are voluntarily added by the employers to maintain wage differences for efficiency reasons. This way, the union bargaining premium is added to the efficiency wage premium.

Expressed differently, when wage differences are important for productivity, the union members need not pay the full price for fairness. Part of the cost can be passed on to the employers. As a result, the median workers may favor a radical wage policy, even if they have relatively weak preferences for fairness.[8] Moreover, if the domino effects are strong enough, an egalitarian wage policy may even lead to a higher median wage.

My analysis suggest that the domino strategy also has some limitations, however.

The lowest paid workers unambiguously gain from an egalitarian wage policy. Also the total wage share is unambiguously increased. But for the better paid majority there is a trade-off. The disadvantage is that they have to allow the lowest paid workers a larger cut of the wage share. The advantage is that the wage share is increased when the employers voluntarily add an efficiency wage premium to the bargaining premium. If the efficiency wage premium is large compared to the bargaining premium, also the better paid majority gains from an egalitarian wage policy. Otherwise, not.

The union's emphasis on fairness in the negotiations must also be sufficiently strong to benefit all members. A weak preference for fairness increases the lowest wages, but at the cost of wage cuts at the top. Thus, unless the members actually have strong preferences for fairness, the union may not even discover the strategic benefits of an egalitarian wage policy. In fact, it is possible that Swedish unions only discovered this idea after their wage policy was radicalized partly for ideological reasons in the late 1960:ies.

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[7]Some theories suggest the opposite, that within-firm wage differences may reduce firm productivity (Akerloff and Yellen, 1988; Levine, 1991). But since the empirical literature shows that employers prefer relatively large wage differences, it seems likely that the *net* effect of wage differences on productive efficiency is positive. There is also some more direct empirical evidence that performance pay and wage inequality actually increases firm productivity see Lazear (2000); Bingley and Eriksson (2001); Heyman (2005); Lallemand et al. (2009); Gielen et al. (2010); Dohmen and Falk (2011).

[8]To explain why the median workers devote so much bargaining power to increase the lowest wages, only their aversion to *advantageous* inequity matters. In experimental studies, many subjects exhibit such aversion to advantageous inequality. But this effect seems to be significantly weaker than their aversion to disadvantageous inequity (Fehr and Schmidt, 1999).

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Once the strategic benefit is discovered, my results suggest that the union will wish to pursue a very radical policy, emphasizing fairness much more than the median member's true preferences motivates.[9] This is an instance of strategic commitment (Schelling, 1960). But such strategic commitment is a delicate task. To be effective, the union must convince the employers that the union will act in the interest of the low paid, rather than the median member. It must be clear that the union is prepared to call a strike for the lowest wages and that it does not accept increases at the top as a substitute. Such commitment may e.g. arise if it is well-known that the union leadership is more radical than the median member. But, to be sustainable, the union must also mobilize support for the radical policy among its members, either by evoking or strengthening the sense of solidarity among its members or by explaining the logic of strategic commitment.[10]

Contribution   While this paper formalizes ideas put forward by Swedish unions and employers, the key mechanism ensues from the interaction of union bargaining power with efficiency wages. And since efficiency wages is a ubiquitous phenomenon, the "domino theory" may have relevance for understanding union bargaining strategy also in other countries.

While this paper may help interpret existing stylized facts, it does not include any additional empirical work to validate the suggested interpretation. The paper also builds on already well-known theoretical building blocks, primarily efficiency wages and bargaining theory. The innovation is simply to combine these building blocks to produce a new explanation of why unions devote so much energy on increasing the lowest wages.

Understanding the egalitarian behavior of unions is important for many reasons. A better model of union behavior may e.g. contribute to our understanding of why wage inequality has increased and why the wage share has decreased after the 1970:ies. Current research suggests that technological change and increased (international) competition have been the primary drivers of these changes. But also reductions in union bargaining power has probably played a role. Union bargaining power is reasonably assumed to have fallen with reduced trade union density and reduced collective bargaining coverage.[11] My analysis suggests an additional reason why unions may have mattered, at least in countries where they remain fairly strong. In the presence of domino effects, modest reductions in the workers' preferences for fairness may have a noticeable impact on union wage policy which, in turn, may have contributed to both increasing wage inequality and a reduced wage share. And, at least in Sweden, the blue-collar union members' aversion to inequity

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[9]In contrast, Rey-Biel (2008) demonstrates that employers may sometimes exploit the workers aversion to inequity by offering contracts which create inequity off-equilibrium, i.e., when employees do not meet the effort targets.

[10]Gumbrell-McCormick and Hyman (2015) discuss various forms of solidarity and their role for unions, with a focus on international issues.

[11]See e.g. OECD (2012). See also Western & Rosenfeld (2011) for a recent contribution arguing that unions may have played a larger role than previously thought.

actually has decreased somewhat during the last decades.[12]

Another reason is that, in the wake of the recent economic crisis, there has been considerable political pressure to lower collectively negotiated minimum wages especially in Greece but also in other European countries including Sweden (see e.g. Bloomberg, 2012). To predict the effects of such policies clearly requires an understanding of the unions' egalitarian behavior. These issues are further discussed in a companion paper (Stennek, 2015).

2 Related literature

Freeman (1980, 1982) argues that American unions have several motives for reducing the dispersion of (blue collar) wages within firms, namely that (i) the median worker earns less than the average, that (ii) solidarity is difficult to maintain if some workers are paid markedly more than others and that (iii) workers prefer objective standards over subjective decisions by foremen.[13]

Farber and Saks (1980) provide some support for the self-interested median voter argument. They demonstrate that the likelihood that an individual will vote for union representation declines as his or her wage increases relative to others in the same bargaining unit. However, Parsons (1982) demonstrates that this voting behavior is the same across bargaining units, independent of whether the median worker earns more or less than the average. He also estimates that the effect of group voting power on the rents received by group members is small and in some cases anomalous in sign. Freeman's (1980) and Frandsen's (2011) find that unions primarily raise the lower tail of the wage distribution. The empirical evidence is thus not supportive of any simple median voter model of union rent distribution policies. Also simple altruism and solidarity arguments are weakened by the fact that more skilled workers are less supportive of union representation.

So, what might explain that unions increase the wages of the lowest paid minorities? Bishop, Formby and Smith (1991) and Agell and Lommerud (1993) argue that the self-interested median voter argument may explain such redistribution, if extended to incorporate the workers' uncertainty about their future position in the wage distribution and risk-aversion. My model will allow for the workers to be risk-averse and to care about fairness. In fact, risk-aversion and equity concerns interact with the domino effects.

Gottfries and Sjöström (2000) present an "insider-outsider explanation" for why unions increase starting wages. According to the insider-outsider theory firms would replace the currently employed if the difference between their wages and the starting wages exceeds

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[12]This is documented in recurrent surveys (LO, 2011b). See also Gumbrell-McCormick and Hyman (2015).

[13]Freeman also suggests that the advantage of standardizing rates between firms is worker solidarity and to (iv) simplify the policing of the union cartel agreement. In addition, he also shows that blue collar unions reduce the gap between blue and white collar workers.

the labor turnover cost. The unions must therefore increase starting wages by the same amount that they wish to increase the insiders' wages.

Frandsen (2011) presents an "agency explanation" for why unions pursue egalitarian wage policies. He assumes that a union leadership facing a U.S. style certification election will commit to a wage policy that maximizes the probability of winning. He argues that the dollar amount by which a union has to increase a worker's earnings to make him indifferent between a union and no union is increasing in a worker's outside wage. One reason is that union dues are commonly collected as a percentage of wages. Thus it is more efficient for the union to shift resources to attract the votes of lower-skilled workers.

Ripple effects   The domino theory implies that unions not only compress wages, but also increase wages for workers further up the wage distribution. This prediction distinguishes it from theories that suggest that unions achieve wage compression by lowering wages at the top of the distribution and increasing those at the bottom.

The crucial element of the domino argument is that there exists a positive link between lower and higher wages. This particular mechanism is consistent with some stylized facts. It has been noted that increases in statutory minimum wages, which may be considered exogenous by individual firms and unions, increase wages higher up in the distribution, so-called ripple or spillover effects. Estimates from different countries differ, but studies for the U.S. find spillovers from economy-wide minimum wages up to the 25th percentile.[14] Previous theoretical research has identified possible reasons for the ripple effects: they may arise when employers substitute and increase demand for skilled workers (Manning, 2003), or since status-conscious skilled workers would reduce work effort to express dissatisfaction with compressed wage differences (Grossman, 1983). Phelan (2014) finds evidence that ripple effects arise as a result of supply substitution rather than demand substitution. Firms are forced to increase higher wages to maintain compensating wage differences, which fits well with the domino theory.

There are also a few empirical studies of how collectively negotiated minimum wages affect the wage structure based on Swedish data. These studies are concerned with the second phase of the solidaristic wage policy.[15] The second phase started in the late 1960:ies when LO started "striving for the elimination of all wage differentials, however caused". The reason for this shift was partly the more radical spirit of the time. And it occurred despite the unions' belief that smaller wage differences within firms would actually hurt

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[14]For a review, see Neumark and Wascher, 2007.

[15]During the first phase of the Swedish Trade Union Confederation's (LO's) so-called solidaristic wage policy, which lasted until the end of the 1960:ies, LO was mainly concerned with wage difference between firms and industries. The unions argued that nation-wide agreements to reduce such wage differences would enhance productive efficiency by speeding up the movement of labor and capital from low to high productive activities (Meidner, 1974). This idea has later been reinforced in formal models (Agell and Lommerud, 1993; and Moene and Wallerstein, 1997) and empirical analyses (Hibbs and Locking, 2000).

firm productivity (Meidner, 1974).[16] Using data from 1971 to 1992, Edin and Holmlund (1994) and Östros (1994) show that youth-specific minimum wages in various industries give rise to spill-overs for the young workers in these industries.[17]

Hibbs and Locking (1996), using more aggregate data, show that union pushes to level wage differences at the national level exerted large positive effects on both centrally negotiated wage changes and local wage drift. The wage drift typically favored the high paid, partly offsetting the equalizing effects of the central agreements.

This finding, that egalitarian wage policies lead to higher wage costs, is corroborated by the Swedish employers. They increasingly opposed a general wage leveling, in favor of an efficiency-wage policy (Meidner, 1974; Elvander, 1988). The employers argued that the attempts to reduce wage differences was part of the reason for the ever higher wage costs in Sweden. The reason is that the centrally agreed reductions of wage differences are partly neutralized by wage drift, i.e. locally agreed increases of the higher wages. The local parties restore the wage differences to increase worker incentives and firm productivity.

Strategic delegation   The main assertion of the domino theory is that (in the presence of ripple effects) the wage share will be higher, the more a union cares for the lowest wages. An implication is that unions may even have an incentive to commit to a more radical policy than motivated by the members' preferences for fairness alone. One commitment method would be the use of strategic delegation.

It may thus be possible to base an empirical test of the domino theory on the prediction that the union members will elect a leadership that is more radical than they are themselves. Lewin (1980) presents Swedish data from a 1974 mail survey about wage policy preferences among union members and officials. The survey was sent to a sample of approximately 2300 members and 800 officers from different unions affiliated with LO. The response rate was above 90 percent. To assess the members' egalitarian attitudes, the respondents where asked to agree or disagree with the claim: "Higher paid groups within LO should support the low-income earners, even if this means that their own demands are set aside." Table 1 shows that there was strong support for egalitarian policies both among regular members and members elected to section, local and central committees.[18] Among the regular members, 78 percent expressed support an egalitarian policy. But the table also reveals differences between members and union officials. Support for the policy increases with the hierarchical level. Among members of central committees, 94 percent

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[16]LO believed that reducing wage differences without hurting firm productivity would require a system of job evaluations. After having failed to construct such a system, the organization saw pushes for uniform increases in cents rather than in percentage terms as a good enough approximation of the ideal policy.

[17]For a review, see Skedinger (2007).

[18]Note that the support for egalitarianism may reflect both a wish to level wage differences between sectors and firms (the so-called Rhen-Meidner model) and wage differences within firms, which is the focus in the present paper.

Table 1: "Higher paid groups within LO should support the low-income earners, even if this means that their own demands are set aside."

	Members	Section committee	Local committee	Central committee
Yes	78 %	85	87	94
No	22	15	13	6
Total	100 (N = 2084)	100 (N = 241)	100 (N = 327)	100 (N = 249)

expressed support for an egalitarian policy. These differences are statistically significant.[19] And, clearly, strategic delegation is one possible explanation for these differences.[20]

3 Model

To concentrate on wage differences within firms, the model consists of a single firm.[21] The firm hires two types of blue-collar workers called B ("the lowest paid") and A ("everybody else"). The share of B-workers is small, $\lambda < \frac{1}{2}$. That is, the median worker is of type A. This simple two-type model allows me to study the stylized fact that unions focus their bargaining power on their lowest paid minorities.

The model assumes for simplicity that all workers are organized and that a collective agreement thus automatically covers all workers. The model may, however, also have relevance in case the union does not succeed to attract all workers as members. The reason is that a collective wage agreement between a firm and a union obliges the firm to pay the same stipulated wages not only to union members but also to unorganized workers.[22] Moreover, the asymmetric Nash bargaining solution, which is used here, includes a parameter to represent the union's bargaining strength. This parameter may be viewed as a "black box" representation of union density and collective agreement coverage.

The timing of events is described in figure 1. First, the workers choose a wage policy. The wage policy describes the union's preferences over wages in different jobs. This choice

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[19]For the alternative hypothesis that the proportion of regular members supporting an egalitarian wage policy is the same as the proportion of section committee members, the p-value is $0.0012 < 0.05$, so we may reject the null hypothesis of equality and conclude that the proportions are different.

[20]There are several reasons to be cautious with the conclusions. One reason is that a union leadership may improve the union's bargaining position by evoking or strengthening the sense of solidarity among its members, thereby reducing the difference in opinion between the leadership and the members. Another reason is that union officials may be more radical than member if radical individuals are more prone to run for union offices.

[21]An alternative interpretation of the model is that there are many *identical* firms represented by a single employers' federation aiming to maximize aggregate profits.

[22]In the United States for example, the Federal Labor Relations Authority certifies unions as exclusive representatives of employees in appropriate units. An exclusive representative is entitled to act for and negotiate collective bargaining agreements covering all employees in the unit. It is responsible for representing the interests of all employees in the unit it represents without discrimination and without regard to labor organization membership (FLRA, 2014). In countries with centralized bargaining, as is common in Europe, collective agreements signed by employer's federations are often extended, often by law, to cover also non-member firms (see e.g OECD, 1994).

Figure 1: Time Line
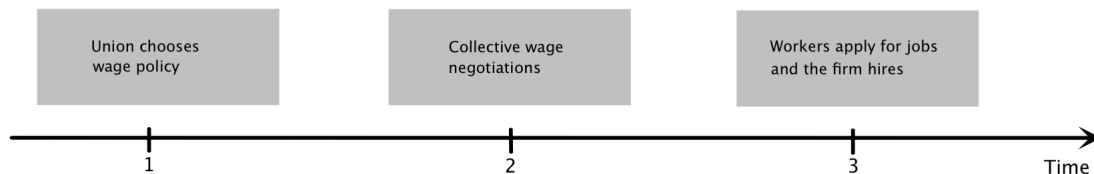
may also be thought of as electing the union leadership, which is responsible for the wage negotiations with the employers (section 5). Second, the union and the firm bargain over the wages (section 4). Statutory minimum wages, if any, are not binding. Third, the workers decide which type of job they wish to apply for and the firm hires all applicants for which the expected profit is positive (section 3). The model is analyzed backwards, to establish a sub-game perfect equilibrium.

The model abstracts from important arguments against increased wage costs. The firm is not put at a competitive disadvantage by increased wages. There is also no inflation nor any unemployment in equilibrium (relaxed in section 6.1).

3.1 Job applications and hiring

The present section analyzes the third stage, job applications and hiring. The key property of this part of the model is that wage differences increase the firm's productivity. To make it simple, there are only two levels of productivity: firm productivity is high if the difference between the wages earned by the two groups of workers exceeds a threshold; otherwise it is low. To be concrete, I use an adverse selection model. But the same formal model may be interpreted many different ways, as discussed in Section 6.2.

Production   There are two types of jobs or techniques. Every worker who takes a "L-job" adds the value v^L to the firm and every worker who takes an "H-job" adds the value $v^H > v^L$. A possible interpretation is that H-jobs produce more units of output in any given time period. An alternative interpretation is that they produce the same number of units but that the quality is higher which means that their output can be sold at a higher price. Yet another interpretation is that "other costs" are lowered by using the H-technique. The total value of production is simply the sum of values produced by the workers. For example, if all workers, of both types, carry out L-jobs, the total value is v^L. But, if all the A-workers carry out H-jobs and all the B-workers carry out L-jobs, the total value is higher and given by $\lambda \cdot v^L + (1 - \lambda) \cdot v^H$.

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Utility   A worker's disutility of effort is an increasing and convex function of the value produced. In particular, I assume that the disutility is quadratic and given by $d_i^j = d_i \cdot (v^j)^2$ for both types of workers, $i = A$ and $i = B$. (Note that sub-indexes are used to differentiate worker types and super-indexes are used to differentiate jobs.) I also assume that the disutility of effort is higher for the B-workers than for the A-workers, i.e. $d_B > d_A$. These assumptions entail that the usual "single crossing" conditions for screening in adverse selection models are satisfied. The single-crossing conditions are given by $d_B^L > d_A^L$ and

$$d_B^H - d_B^L > d_A^H - d_A^L. \tag{1}$$

The utility of a worker of type i who takes a job of type j is given by $u = w^j - d_i^j$, where w^j is the wage in job j.[23] The utility outside employment is normalized to zero. Thus, the disutility of work must be interpreted broadly to include e.g. the lost value of leisure and unemployment benefits.

Efficiency   The number of L- and H-jobs are endogenous; they are determined by job applications and hiring decisions. Efficiency requires that the firm hires the B-workers to carry out L-jobs if

$$v^L - d_B^L > v^H - d_B^H, \tag{2}$$

and that the firm hires the A-workers to carry out H-jobs if

$$v^H - d_A^H > v^L - d_A^L. \tag{3}$$

These conditions are satisfied if $d_B > \left[v^H + v^L\right]^{-1} > d_A$, which is assumed.

The maximum total surplus is denoted by $S = (1 - \lambda) \cdot \left(v^H - d_A^H\right) + \lambda \cdot \left(v^L - d_B^L\right)$ and since the number of workers is normalized to one, the total surplus is also the average surplus per worker.

Information   The parties agree on the wage schedule $\left(w^L, w^H\right)$ but cannot decide on employment directly. Individual workers have private information about their types and select which jobs they wish to apply for. The firm decides unilaterally what applicants they wish to hire, but without observing their types.

In order for the parties to produce the maximum total surplus, they would have to agree on a wage schedule that induces workers to apply for the jobs they are suited for, while granting the firm a positive profit when hiring all applicants. In particular, the wage schedule has to satisfy both rationality and incentive compatibility constraints for both the workers and the firm.

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[23]Since the disutility of effort is assumed to be independent of the wage, the efficiency wage premium necessary to induce A-workers to apply for H-jobs will be independent of the union bargaining power.

Worker incentives   To apply for jobs, the wages must compensate the workers for their disutility of work. The wage paid for L-jobs has to compensate the B-workers for their disutility of low effort and the wage paid for H-jobs has to compensate the A-workers for their disutility of high effort, i.e.

$$w^L - d_B^L \geq 0, \tag{4}$$

$$w^H - d_A^H \geq 0. \tag{5}$$

Unless these *individual rationality* constraints are fulfilled, the workers would prefer to remain unemployed. Expressed differently, the wage schedule must lie above the IR_A-line and to the right of the IR_B-line in figure 2, on the following page.

The wage structure must also induce the B-workers to voluntarily choose the L-jobs over the H-jobs and the A-workers to prefer H-jobs to L-jobs, i.e.

$$w^L - d_B^L \geq w^H - d_B^H, \tag{6}$$

$$w^H - d_A^H \geq w^L - d_A^L. \tag{7}$$

These *incentive-compatibility* constraints place restrictions on wage differences. The A-workers' incentive-compatibility constraint ("IC_A") requires the wage for H-jobs to be sufficiently high compared to the wage for L-jobs. Whatever the wage for L-jobs is, the wage for H-jobs must be larger and compensate the A-workers for the extra effort required, i.e. $w^H - w^L \geq d_A^H - d_A^L > 0$. Expressed differently, the wage schedule must lie above the IC_A-line in figure 2. The incentive-compatibility constraint for the B-workers will be excluded from now on, since it will not play any role in the analysis to follow (think of d_B^H as extremely high, e.g. $d_B^H > v^H$).

Firm incentives   The wage structure must grant the firm a non-negative profit. When the efficient outcome is implemented, the requirement is that $\pi = \lambda \cdot \left(v^L - w^L \right) + (1 - \lambda) \cdot \left(v^H - w^H \right)$ is positive. The wage structure must also ensure that the firm wishes to hire both types of workers, i.e.

$$w^H \leq v^H \tag{8}$$

$$w^L \leq v^L. \tag{9}$$

These two *right-to-manage* constraints are described by the two dotted lines in figure 2.

Efficient wages   The gray area in figure 2, defined by inequalities (4) - (9), represents all wage schedules inducing workers to apply for the jobs that maximize the total surplus and also the firm to hire all applicants. I will call all such wage schedules *efficient* and other wage schedules non-efficient. While every efficient wage schedule maximizes the total

surplus, they entail different divisions of this surplus between the firm and the different types of workers.

4   Wage setting

Before studying collective negotiations, it is instructive to note that a firm which could set wages unilaterally would chose the wage schedule $\left(w_E^L, w_E^H\right)$ described by the E-dot in figure 2. The proof is straightforward. Any straight line parallel to the π^0-line, within

Figure 2: Unilateral wage setting
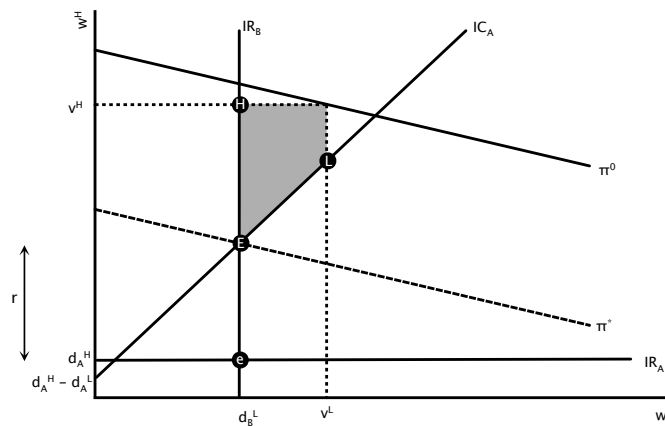
the efficient set, is an iso-profit curve. Lower lines represent higher profits. Thus, among the efficient wage schedules, profit is maximized by the one represented by the E-dot. To maximize profits, the B-workers should simply be offered compensation for their disutility of work, i.e. $w_E^L = d_B^L$. This follows from the fact that the IR_B-constraint is binding. The profit-maximizing wage for the A-workers, is found by solving the binding IC_A-constraint. Thus, $w_E^H = d_B^L + \left(d_A^H - d_A^L\right)$, where the second term is a compensating wage differential, compensating the A-workers for acquiring a higher education or accepting less desirable job attributes.

An important feature of this wage schedule is the well-known efficiency wage premium (or information rent) earned by the A-workers. That is, the A-workers receive a wage in excess of the level sufficient to compensate them for their disutility of working:

$$u_H = w_E^H - d_A^H = \left[d_B^L + \left(d_A^H - d_A^L\right)\right] - d_A^H = d_B^L - d_A^L \equiv r > 0.$$

This *monopsonistic efficiency wage premium* is paid by the firm to prevent the A-workers from accepting a low-paid low-effort job. Therefore, the efficiency wage premium has to be at least as high as the utility the A-workers would derive from choosing a L-job $(w_E^L - d_A^H = d_B^L - d_A^L)$. In figure 2 the efficiency wage premium is described by the distance between the E-dot located on the incentive-compatibility constraint and the e-dot located

on the individual rationality constraint. The A-workers do not need any bargaining power to secure this wage premium. Even if the firm has the power to set wages unilaterally, it offers this premium to increase efficiency. The B-workers, on the other hand, receive no such premium.

Finally, I need to show that the firm indeed has an incentive to implement the efficient outcome, rather than e.g. not offering any low-effort jobs. More generally, the condition for the firm to implement the efficient outcome turns out to be necessary and sufficient for non-efficient wage schedules to be Pareto dominated.

Lemma 1. *Every non-efficient wage schedule is Pareto dominated by some efficient wage schedule if, and only if,*

$$\lambda \cdot \left(v^L - d_B^L\right) \geq (1 - \lambda) \cdot \left(d_B^L - d_A^L\right). \tag{10}$$

The proof is relegated to Appendix A.

Condition 10 requires that the B-workers' contribution to total production (which is equal to the left hand side of the inequality) is larger than the total efficiency wage premium paid by the firm (which is equal to the right hand side of the inequality). Unless this condition is satisfied, the firm may prefer wage schedules causing B-workers to be unemployed and A-workers to take on H-jobs without requiring an efficiency wage premium.

In the remainder of the paper, I will assume that condition (10) is satisfied and that wages are set in efficient bargaining. Since all non-efficient wage schedules are Pareto dominated, the equilibrium wages will always be efficient. Thus, the only remaining issue is how the total surplus is distributed between the firm and the workers of different types.

4.1 Collective bargaining with an extremely median-biased union

Wages are determined through collective bargaining between the union and the firm. I represent this negotiation by the asymmetric Nash bargaining solution. The firm's objective is to maximize profit and the union's objective is to maximize some measure of the utility of its members. The disagreement payoff is assumed to be zero for both the firm and the workers. The asymmetric Nash product is then given by

$$N\left(w^H, w^L\right) = \pi\left(w^H, w^L\right)^{1-\beta} \cdot U\left(w^H, w^L\right)^{\beta}$$

where $\beta \in [0, 1]$ is the union's bargaining power.[24] For simplicity I start out assuming

[24]The normal interpretation of the disagreement payoffs is that they represent the parties' utility levels during a labor market conflict, even though a conflict will not occur in equilibrium. Thus, in effect, I assume that a worker's payoff during conflict is the same as when unemployed and the firm's profits during conflict are the same as if they would leave the market. This is clearly a simplification since e.g. unemployment benefits may differ from disbursements from strike funds. According to the standard

that the union either only cares about the A-workers or the B-workers.

Consider first the case that the union only cares about the A-workers. Assuming the negotiation leads to efficiency, the union's payoff function is given by $U_H\left(w^H\right) = w^H - d_A^H$. The firm's payoff is its profit. The Nash product is thus given by $N_H\left(w^H, w^L\right) = \left[\lambda \cdot \left(v^L - w^L\right) + (1 - \lambda) \cdot \left(v^H - w^H\right)\right]^{1-\beta} \cdot \left[w^H - d_A^H\right]^{\beta}$. The bargaining outcome is the efficient wage schedule maximizing the Nash product. Since the firm wishes to minimize the wage for L-jobs and since the union does not mind, the participation constraint for the B-workers must bind, i.e. $w^L = d_B^L$. The Nash product can then be rewritten as

$$N_H\left(w^H, w^L\right) = \left[S - (1 - \lambda) \cdot \left(w^H - d_A^H\right)\right]^{1-\beta} \cdot \left[w^H - d_A^H\right]^{\beta},$$

where $S = \lambda \cdot \left(v^L - d_B^L\right) + (1 - \lambda) \cdot \left(v^H - d_A^H\right)$ is the total surplus, which is to be shared between a union receiving the wage premium $w^H - d_A^H$ and the firm receiving the rest, $S - (1 - \lambda) \cdot \left(w^H - d_A^H\right)$. Notice that increasing the A-workers' wage premium only reduces the firm's profit in proportion to the share of A-workers, $1 - \lambda$.

Disregarding the incentive-compatibility and the right-to-manage constraints, the wage premium for H-jobs is set equal to

$$w_{eh}^H - d_A^H = \frac{1}{1 - \lambda} \cdot \beta \cdot S. \tag{11}$$

To prove this claim, simply solve the first-order condition $\partial N_H\left(w^H, d_B^L\right) / \partial w^H = 0$. This wage premium is called the *bargaining premium*. It is simply the union's share of the total surplus, distributed among the A-workers. To be more precise, it is called the A-wo*rker's direct bargaining premium* to emphasize that it is the premium earned by the A-workers when they use the unions bargaining power to increase their wages directly, i.e. absent strategic delegation.

This (semi-) unconstrained maximum of the Nash product is represented by the eh-dot in figure 3. The eh-dot is a convex combination of the e-dot and the h-dot. The h-dot is located on the firm's participation constraint giving the firm zero profit and thus giving the whole surplus to the A-workers (disregarding the right-to-manage constraint). The e-dot is located on the A-workers' participation constraint, giving the firm the whole surplus (disregarding the IC constraint). The exact location of the eh-dot between the h-dot and the e-dot is determined by the parties' bargaining power. If the union has much bargaining power the equilibrium is close to the h-dot. If the union has little bargaining power the equilibrium is close to the e-dot. With equal bargaining power ($\beta = \frac{1}{2}$) as assumed in the figure, the equilibrium is the mid point between the h-dot and the e-dot. Clearly, the unconstrained maximum satisfies the right-to-manage constraint if the

interpretations the union has high bargaining power if it is more patient or less risk-averse than the firm. See Binmore, Rubinstein and Wolinsky (1986) for justifications.

14

Figure 3: Collective bargaining: Union maximizes median wage
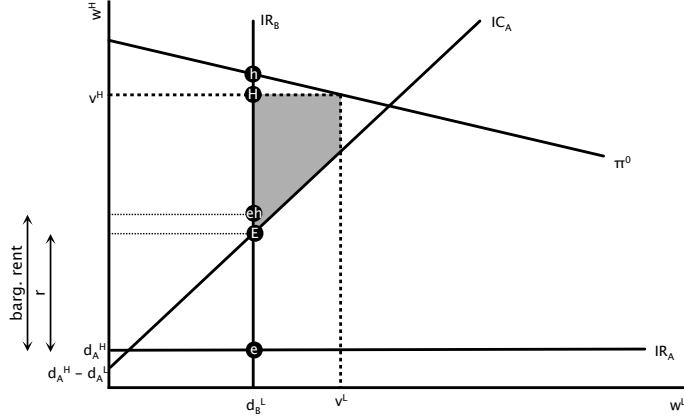
union's bargaining power is not too high.[25]

Taking the incentive-compatibility constraint into account is straightforward. As long as the eh-dot satisfies the incentive-compatibility constraint (as assumed in the figure), it must represent the bargaining outcome. Otherwise, the constrained equilibrium coincides with the wages that the firm would set if it could dictate wages. In other words the equilibrium wage schedule $\left(w_{eh}^H, w_{eh}^L\right)$ is given by

$$w_{eh}^L = d_B^L,$$

$$w_{eh}^H = d_A^H + \max\left\{r, \frac{1}{1-\lambda} \cdot \beta \cdot S\right\}.$$

The interesting feature of this agreement is that the A-workers either get the monopsonistic efficiency wage premium (r) or the direct bargaining premium ($\frac{1}{1-\lambda} \cdot \beta \cdot S$) depending on which is larger. But they don't get both.

One may define the *efficiency wage premium* as any wage premium in addition to the bargaining premium. When the union pursues a median-biased wage policy, the efficiency wage premium is given by

$$\tilde{r} = \max\left\{r - \frac{1}{1-\lambda} \cdot \beta \cdot S, 0\right\}. \tag{12}$$

If the union has no bargaining power ($\beta = 0$), the efficiency wage premium coincides with the monopsonistic efficiency wage premium ($\tilde{r} = r$). If the union's bargaining power is increased, the A-workers' (direct) bargaining premium is increased, but the efficiency wage premium is reduced ($\partial \tilde{r}/\partial \beta < 0$). Due to the simplicity of the model the efficiency wage premium is reduced by the same amount as the bargaining premium is increased,

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[25]The right-to-manage constraint is satisfied if and only if $\frac{\beta}{1-\beta} \cdot \frac{\lambda}{1-\lambda} \cdot \frac{v^L - d_B^L}{v^H - d_A^H} \leq 1$. A sufficient condition is that $\beta \leq \frac{1}{2}$. But with very few minimum-wage earners, any $\beta \leq 1$ is allowed.

until the efficiency wage premium is completely eliminated. One may thus say that the bargaining premium and the efficiency wage premium are substitutes. Intuitively, the higher the wage premium the A-workers can secure through collective bargaining, the lower is the additional efficiency wage premium that the firm has to offer A-workers to make them accept the high-effort jobs.

Some readers may find it disturbing that the Nash bargaining solution is determined as a convex combination of the e-dot and and the h-dot, given that not even the firm would set the wage as low as d_A^H. The lowest wage the A-workers would credibly be held down to in the negotiation is $d_A^H + r$. It should be noted, however, that since the A-workers loose the efficiency wage premium during a conflict, it does not add to their bargaining power. The efficiency wage premium is irrelevant for the Nash bargaining outcome, except as a constraint.[26]

4.2 Collective bargaining with an extremely egalitarian union

Consider second the case that the union only cares about the B-workers. Assuming the negotiation leads to efficiency, the union's payoff function is given by $U_L(w^L) = w^L - d_B^L$. The firm's payoff is its profit and the Nash product is given by $N_L(w^H, w^L) = [\lambda \cdot (v^L - w^L) + (1 - \lambda) \cdot (v^H - w^H)]^{1-\beta} \cdot [w^L - d_B^L]^\beta$. Again, the bargaining outcome is the efficient wage schedule maximizing the Nash product. Since the firm wishes to minimize the wage for the H-jobs and since the union does not mind, the incentive compatibility constraint for the A-workers must bind, i.e. $w^H = w^L + (d_A^H - d_A^L)$. The Nash product can then be rewritten as

$$N_L(w^H, w^L) = \left[\tilde{S} - (w^L - d_B^L)\right]^{1-\beta} \cdot \left[w^L - d_B^L\right]^\beta. \tag{13}$$

In effect, the negotiation is concerned with sharing a perceived surplus equal to $\tilde{S} = S - (1 - \lambda) \cdot r$ between a union receiving the B-premium $w^L - d_B^L$ and the firm receiving $\tilde{S} - (w^L - d_B^L)$. Since none of the parties care about the A-workers' welfare they simply perceive the efficiency wage premium $(1 - \lambda) \cdot r$ as a cost of production that should be deducted from S. Also notice that increasing the B-workers' wage premium reduces the firm's profit by the same amount since also the A-workers' wage is increased at the same time.

Sharing the perceived surplus according to bargaining power implies that the wage

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[26]Interpreted properly, this critique is simply an instance of an already well-known argument against that Nash bargaining solution, namely that it satisfies the "independence of irrelevant alternatives" axiom (which is a misnomer). Kalai and Smorodinsky (1975) suggest an alternative bargaining solution replacing the independence axiom with a monotonicity requirement. In the present context the requirement is that w_{eh}^H should be increasing in r. It is straightforward to demonstrate that the bargaining premium and the efficiency wage premium are substitutes, also with this solution.

premium for L-jobs is set equal to

$$w_{el}^L - d_B^L = \beta \cdot \tilde{S}.$$

The wage premium for H-jobs is thus given by

$$w_{el}^H - d_A^H = \beta \cdot \tilde{S} + r.$$

Note that $\beta \cdot \tilde{S}$ is the B-workers' bargaining premium but *indirectly* it is also the A-workers' bargaining premium.

Recall that the A-workers' efficiency wage premium is any wage premium in addition to the bargaining premium. Since the A-workers receive the same bargaining premium as the B-workers, it is necessary to add the monopsonistic efficiency wage premium, r, to induce the A-workers to volunteer for the more H-jobs.[27]

The equilibrium wages are represented by the el-dot in figure 4 which is simply a convex combination of the l-dot and the E-dot. In a Nash negotiation, the two parties

Figure 4: Collective bargaining: Union maximizes lowest wage.
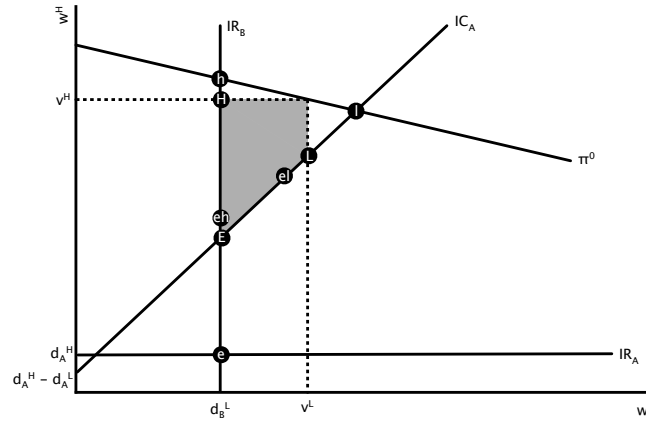
must share the surplus according to bargaining power. The l-dot, located on the firm's participation constraint, gives the union the whole surplus and the E-dot located on the B-workers' participation constraint, gives the firm the whole surplus.

4.3 Comparing the two extreme policies

The union's wage policy affects the equilibrium wages. Not surprisingly the B-workers' wage is higher when the union pursues an egalitarian wage policy, i.e. $w_{el}^L - d_B^L = \beta \cdot \tilde{S} >$

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[27]To prove this claim, simply solve the first-order condition $\partial N_L \left(w^H \left(w^L \right), w^L \right) / \partial w^L = 0$. The wage satisfies the right-to-manage constraint if and only if $\frac{\beta(1-\lambda)}{1-\beta \cdot \lambda} \leq \frac{v^L - d_B^L}{\left(v^H - d_A^H \right) - r}$. A sufficient condition that the union's bargaining power is not too large. If the right-to-manage constraints bind, the constrained equilibrium is given by the L-dot.

$0 = w_{eh}^L - d_B^L$. Given that wage differences improve productive efficiency and that the firms oppose wage leveling, it should be expected that an egalitarian wage policy is costly for the union, in the sense that an egalitarian wage policy is associated with a lower total wage bill. It turns out that the opposite is true: An egalitarian wage policy results in a higher total wage bill.[28] The intuition is explained after the next lemma.

For the A-workers, the union's choice of wage policy implies a trade-off between the bargaining premium and the efficiency wage premium. The disadvantage with an egalitarian wage policy is that it reduces the A-workers' bargaining premium. That is, the "indirect" bargaining premium is smaller than the "direct" bargaining premium:

$$\beta \cdot [S - (1-\lambda) \cdot r] \leq \frac{1}{1-\lambda} \cdot \beta \cdot S.$$

There are two reasons for this inequality. First, a minimum-wage maximizing union perceives the surplus to be smaller since the efficiency wage premium is considered a cost of production that is deducted from the total surplus. Second, the union's bargaining surplus is shared between all workers, including the B-workers. The advantage with an egalitarian wage policy is that it increases the A-workers' efficiency wage premium:

$$r \geq \max \left\{ r - \tfrac{1}{1-\lambda} \cdot \beta \cdot S, 0 \right\}.$$

The reason is that when the union maximizes the wage in H-jobs, the efficiency wage premium is reduced by the bargaining premium.

The first main result of the paper is that the A-workers sometimes earn more if wage negotiations are delegated to an agent who only cares about the lowest wage rather than to one who only cares about the median wage. Clearly, if $r > \frac{1}{1-\lambda} \cdot \beta \cdot S$ the A-workers would waist all their bargaining power by focusing on their own wage directly. Then an egalitarian wage policy increases the median wage. But also in the opposite case, the A-workers sometimes earn a higher wage with an egalitarian wage policy, as revealed by figure 4. The condition is

$$r > \theta \cdot \frac{1}{1-\lambda} \cdot \beta \cdot S, \tag{14}$$

where $\theta = \frac{\lambda}{1 - \beta \cdot (1-\lambda)} < 1$. In summary:

Lemma 2. *The median workers' wage is higher under an extreme egalitarian wage policy than under a median-biased wage policy if and only if the monopsonistic efficiency wage premium is large enough compared to the direct bargaining premium.*

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[28]With a median-biased wage policy the total wage premium is $(1-\lambda) \cdot \left(w_{eh}^H - d_A^H\right) = \max\{(1-\lambda) \cdot r, \beta \cdot S\}$. With an egalitarian wage policy, the total wage premium is $\lambda \cdot \left(w_{el}^L - d_B^L\right) + (1-\lambda) \cdot \left(w_{el}^H - d_A^H\right) = \beta \cdot \tilde{S} + (1-\lambda) \cdot r = \beta \cdot S + (1-\beta) \cdot (1-\lambda) \cdot r$. Thus, an egalitarian wage policy increases the total wage bill if $(1-\lambda) \cdot r \leq \beta \cdot S$ or if $(1-\lambda) \cdot r > \beta \cdot S$ and $S \geq (1-\lambda) \cdot r$. The last inequality is implied by 10.

Intuitively, if the union uses its bargaining power to push up the wage for the more H-jobs, the firm does not need to add any efficiency wage premium to guarantee that A-workers take on these jobs. If the union redirects its bargaining power to push up the wage for L-jobs, it may rely on the firm to voluntarily top up the A-workers' wages to protect efficiency-enhancing wage differences. The A-workers will get the efficiency wage premium on the side.

4.4   General union preferences

Consider now the general case when the union's objective function both attaches a weight $\alpha \geq 0$ on the B-workers' wage premium and a weight $1 - \alpha \geq 0$ on the A-workers' wage premium. That is, the union's wage policy is described by

$$U_\alpha \left(w^H, w^L\right) = (1 - \alpha) \cdot \left(w^H - d_A^H\right) + \alpha \cdot \left(w^L - d_B^L\right),$$

when the efficient outcome is implemented.

The analysis above investigated the two extreme cases when $\alpha = 0$ and $\alpha = 1$. Figure 5 illustrates the relation between the equilibrium wages earned by the two groups and the

Figure 5: Equilibrium wages with generalized policy

(a) Basic jobs   (b) Advanced jobs
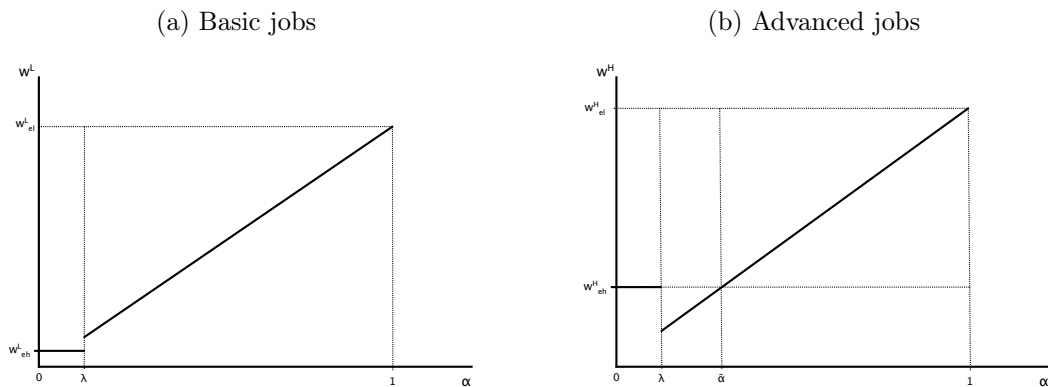
strength of the union's equity concern, for all $\alpha \in [0, 1]$, for the case when condition 14 is satisfied. The B-workers wage is increasing in α. More interestingly, the A-workers wage is quasi-convex in α.[29]

To understand the figure, note that the firm is willing to agree on any reallocation of wages keeping the profit constant (i.e. along an iso-profit curve within the feasible set). If the union is relatively median-biased, giving B-workers a lower weight in the objective

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[29] Actually, this convexity could be strengthened by using a somewhat more realistic but complicated model. In particular, the A-worker's wage would be *strictly decreasing* in α (at a decreasing rate), for α below some $\ddot{\alpha}$, and then strictly increasing (at an increasing rate) for α above $\ddot{\alpha}$. In particular, this would be the case if the union's wage policy would be multiplicative, i.e. $U_\alpha = (1 - \alpha) \cdot ln \left(w^H - d_A^H\right) + \alpha \cdot ln \left(w^L - d_B^L\right)$, rather than linear as assumed here.

function than their share of the workforce (i.e. $\alpha < \lambda$), the union wishes to maximize w^H on any iso-profit curve. Thus, IR_B must bind in equilibrium (assuming that the union's bargaining power is insufficient to capture the A-workers' total productivity). It follows that $w^L = d_B^L$. Maximizing the Nash product over w^H yields the same solution independent of $\alpha < \lambda$. The solution must therefore coincide with the solution when the union only cares about the median wage premium, $\alpha = 0$, derived above.

If the union is egalitarian, giving B-workers a higher weight in the objective function than their share of the workforce (i.e. $\alpha > \lambda$), the union wishes to maximize w^L on any iso-profit curve. Thus, IC_A binds in equilibrium (assuming that the union's bargaining power is insufficient to capture the B-workers' total productivity). Thus, $w^H = w^L + \left(d_A^H - d_B^L\right) + r$, and the Nash product can be rewritten as $N\left(w^H, w^L\right) = \left[\tilde{S} - \left(w^L - d_B^L\right)\right]^{1-\beta} \cdot \left[\left(w^L - d_B^L\right) + (1-\alpha) \cdot r\right]^{\beta}$. Solving the first-order condition gives $w_\alpha^L - d_B^L = \beta \cdot \tilde{S} - (1-\beta) \cdot (1-\alpha) \cdot r$. And the median wage premium is $w_\alpha^H - d_A^H = \beta \cdot \tilde{S} + r - (1-\beta) \cdot (1-\alpha) \cdot r$. Both premia are increasing in α. The intuition is simple: the union is weakened by considering the efficiency wage premium $r = d_B^L - d_A^L > 0$ as a gain in the negotiation.

For future reference I define $\tilde{\alpha} > \lambda$ to be the weight on the B-workers wage premium such that $w_\alpha^H = w_{eh}^H$ whenever condition 14 is satisfied.

5   Choice of wage policy

Before the collective bargaining starts, the union members must decide what wage policy the union should pursue. The wage policy would be codified in official documents but also embodied in the members' choice of the union's leadership, e.g. the chief wage negotiator.[30] Here, the wage policy is simply modeled as the union's objective function, U_α. The question is what weight α the union should attach to the B-workers' wage.

As unions are democratic organizations, I assume that the wage policy α is chosen to maximize the utility of the median workers. Clearly, if the B-workers would constitute the majority, the union would pursue an egalitarian wage policy. But the evidence suggests that unions emphasize the wages of low-paid *minorities*. To understand this phenomenon within a two-type model, I need to study the case when the median worker has the higher wage.

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[30]For example, Swedish Municipal Workers' Union revised its wage policy 1993 (emphasizing efficiency) and 2004 (emphasizing equality). These changes occurred after changes in the leadership.

5.1 Fairness and risk

Surveys suggest that union members care about fairness.[31] The sense of fairness varies over time and most likely between different countries. To model fairness concerns in a simple yet flexible way, I use the format suggested by Fehr and Schmidt (1999). Since the median worker decides the union's wage policy, I only need to describe the A-workers' preferences. Since the A-workers wage premium is higher than the B-workers wage premium, I only need to specify the A-workers' distaste for advantageous inequity. Thus, the A-workers' utility is given by

$$u_{\alpha'} = \left(w^H - d_A^H\right) - \alpha' \cdot \left[\left(w^H - d_A^H\right) - \left(w^L - d_B^L\right)\right],$$

where $\alpha' \in [0, 1]$ measures how averse they are to advantageous inequity. (This parameter is normally denoted by β in the fairness literature.) Notice that I, for simplicity, only consider *equity* norms (comparisons of wage premia) and not *equality* norms (comparison of wages). An increase in the strength of the median workers' solidarity with the lowest paid workers is thus simply described by an increase in α'.[32]

Notice that the A-workers' utility function can also be rewritten as

$$u_{\alpha'} = (1 - \alpha') \cdot \left(w^H - d_A^H\right) + \alpha' \cdot \left(w^L - d_B^L\right).$$

The parameter α' may then be interpreted as a rudimentary model of risk and risk-aversion, with α' being larger the more likely it is that an A-worker is transformed into a

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[31]In interview studies, employees report caring about the well-being of their co-workers and not only their own (Blinder and Choi, 1990, Campbell and Kamlani, 1997, Agell and Lundborg, 1999). There are several complementary reasons why the well paid workers may prefer more equal wages. One reason is that the median workers care for other people with lower wages. Another reason may be that people do not know their own (or their childrens') future wage (Agell and Lommerud, 1992).

[32]The debate within Swedish unions demonstrates that also the choice of norm is part of the issue. The Swedish unions' wage policy became more radical in the late 1960:ies. Earlier, LO was mainly concerned with wage difference between firms and industries. They adhered to a weak equity norm "equal pay for equal work," independent of firms' different abilities to pay. LO then switched to the equality norm "equal pay for all work." This shift was not only motivated by the more radical spirit of the time. Another reason was that the middle ground, in the form of a strong equity norm (pay in relation to e.g. effort, hardship or education), would require a system of job evaluations, which was too difficult to implement. See e.g. Meidner (1974) and Elster (1989).

B-worker and the more risk-averse the worker is.[33]

Consider first the possibility that strategic delegation is impossible or that the unions have not realized this possibility. Then, the union's wage policy (i.e. its objective function) must coincide with the median workers' true preferences, i.e. $\alpha = \alpha'$. The following result follows immediately from figure 5:

Proposition 1. *Assume that the union's wage policy must coincide with the median workers' preferences. The median workers pay for their inequity-aversion (or risk-aversion) by accepting a lower wage for themselves, unless (i) the monopsonistic efficiency wage premium is sufficiently large in relation to the direct bargaining premium (14 is satisfied) and unless (ii) they are sufficiently averse to inequity or risk ($\alpha' > \tilde{\alpha}$).*

This result provides a possible interpretation of the Swedish experience in the late 1960:ies when unions started to pursue a more egalitarian wage policy, partly as a result of the more radical ideology of the time (Meidner, 1974). It is possible that the domino effects, or the strength of them, first came as a surprise to the unions. (Recall that w^H is falling in α at low levels.) It is only much later that the Swedish unions started to motivate their egalitarian wage policy as a bargaining tactic (Nilsson, 1989).[34]

5.2 Strategic delegation

A wage negotiation is a strategic situation and the outcome is determined through the interaction between the firm and the union. As Schelling (1960) pointed out, even if union representatives are elected to maximize the utility of the median voter, the most effective representative need not share the principal's preferences. In fact, one main idea of this paper is to investigate if the median wage earners can benefit from electing union representatives with stronger preferences for equity than they have themselves. My analysis will be framed in terms of such strategic delegation.[35]

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[33]Assume that an A-worker is transformed into a B-worker with probability $1-p$. The median worker's expected utility is then $EV = p \cdot V\left(w^H - d_A^H\right) + (1-p) \cdot V\left(w^L - d_B^L\right)$ where V is concave to represent risk-aversion. For simplicity assume that V is piece-wise linear with

$$V'(w-d) = \begin{cases} 1 & if \quad w-d < \xi \\ \gamma & \quad w-d > \xi \end{cases}$$

where a low $\gamma \in [0,1]$ signifies risk-aversion. Then, for $w^H - d_A^H > \xi > w^L - d_B^L$, expected utility is given by $EV = p \cdot (1-\gamma) \cdot \xi + p \cdot \gamma \cdot \left(w^H - d_A^H\right) + (1-p) \cdot \left(w^L - d_B^L\right)$ which after an affine transformation becomes $E\tilde{V} = \frac{p \cdot \gamma}{p \cdot \gamma + (1-p)} \cdot \left(w^H - d_A^H\right) + \frac{(1-p)}{p \cdot \gamma + (1-p)} \cdot \left(w^L - d_B^L\right)$. Then, $\alpha' = \frac{(1-p)}{p \cdot \gamma + (1-p)}$ is increasing in risk (a lower p) and in risk-aversion (a lower γ).

[34]Against the surprise hypothesis, it may be said that the central framework agreements contained clauses related to wage drift already from 1966.

[35]Schelling mentions several other bargaining tactics that may achieve similar results as delegation. These tactics presume that the initiative comes from the leadership. The union leadership may publicly announce their ambition to raise the wages of the least well off, thereby making themselves responsible for fulfilling the expectations they create. European unions often articulate normative views about

Assume first that the A-workers do not care for equity at all ($\alpha' = 0$). Still, if the union can commit to a wage policy that deviates from the median workers' true preferences, it will clearly pursue an extreme egalitarian wage policy ($\alpha = 1$) if their own wage would increase as a result of such a policy (i.e. if inequality 14 is satisfied).

But the motive may also be a mix of fairness and strategy. Expressed differently, even in the case when an egalitarian wage policy would result in a lower wage for the A-workers, i.e. $w_{eh}^H < w_{el}^H$, they may still wish to pursue an egalitarian wage policy since (i) their loss is relatively modest thanks to the domino effects and since (ii) they may care about fairness.

To see this, first recall that the A-workers will choose one of the two extreme wage policies for the union. The reason is that the B-workers' wage is increasing in the unions' equity concerns and that the A-workers' wage is quasi-convex in the union's equity concerns. Moreover, in case the negotiator maximizes the median wage premium ($\alpha = 0$), the equilibrium wage structure is given by $\left(w_{eh}^H, w_{eh}^L\right)$ and the A-workers' utility is given by $(1 - \alpha') \cdot \frac{1}{1-\lambda} \cdot \beta \cdot S$. In case the negotiator maximizes the low-wage premium ($\alpha = 1$), the equilibrium wage structure is given by $\left(w_{el}^H, w_{el}^L\right)$ and the A-workers' utility is given by $(1 - \alpha') \cdot \left(\beta \cdot \tilde{S} + r\right) + \alpha' \cdot \frac{\lambda}{1-\lambda} \cdot \left(\beta \cdot \tilde{S}\right)$. Thus, the A-workers prefer an extreme egalitarian wage policy over an extreme median-biased policy if

$$r > \theta' \cdot \frac{1}{1 - \lambda} \cdot \beta \cdot S, \tag{15}$$

where $\theta' = \frac{\lambda - \alpha'}{1 - \beta + \beta \cdot \lambda - \alpha'} \leq \theta$ is a decreasing function of α'. Otherwise, they elect a negotiator maximizing the median wage. In sum:

Proposition 2. *The median workers prefer an extreme egalitarian wage policy if, and only if, the monopsonistic efficiency wage premium is large enough compared to the direct bargaining premium. The more the median workers care about fairness (or the more risk-averse they are), the lower is the requirement on the monopsonistic efficiency wage premium.*

This proposition formalizes the idea that unions pursue egalitarian wage policies partly for strategic reasons as a result of the domino effect. Even if the median workers' true

distributive justice, with which they justify their wage claims, at the outset of every collective bargaining round. The distributive conflict - as presented by the unions - is not only one between capital and labor but also one between different groups of employees (Schulten, 2004). In the longer run the union might be able to build up a reputation for strong equity concerns by striking for increased wages at the bottom. It may also be possible for the union to commit to an egalitarian wage policy and improving its bargaining position by evoking or strengthening the sense of solidarity among its members. An american example is Walter Reuther, head of the United Auto Workers (UAW), who aimed to "reshape the consciousness of millions of industrial workers, making them disciplined trade unionists, militant social democrats, and racial egalitarians" (see Lichtenstein, 1995). More broadly, Western & Rosenfeld (2011) argue that the (industry) unions' promotion of distributional norms in public discourse has reduced wage inequality through many different channels, also outside the wage negotiation room. My analysis is complementary in demonstrating how an equity norm, focusing on the lowest wages, may benefit all union members.

equity concerns are modest, an egalitarian wage policy may increase their wage if the efficiency wage premium is large enough. The proposition thus formalizes the views expressed by Swedish unions: "Even if only a few people are affected directly, increasing the lowest wages is absolutely decisive for the wage level of the entire group" (Kommunal, 2003; Landsorganisationen, 2011).

My study helps clarify why and when the unions are able to increase the general wage level by *redirecting* their bargaining power from wages in general to a focus on the lowest wages. But my analysis also reveals a couple of limitations. First, as already noted above, the union may not even discover the importance of the domino effects unless the workers actually have quite substantial equity concerns ($\alpha' > \lambda$). Second note that if the A-workers' true equity concerns are modest ($\alpha' < \lambda$), the union's policy must deviate quite substantially from the median workers' preferences (i.e. $\alpha > \tilde{\alpha} > \lambda > \alpha'$) to ensure that the median workers do not lose part of their own wage premium. This result suggests that strategic commitment initiated by the union leadership may be a risky strategy. Such a policy may alienate well-paid members if they do not understand the logic of the strategy.

Consider finally a situation where the domino effects are insufficient for an egalitarian wage policy to increase the wage for the A-workers, i.e. $w_{eh}^H < w_{el}^H$. The union may nevertheless pursue an extreme egalitarian wage policy for mixed reasons, i.e. a combination of fairness and strategy. In particular, the A-workers prefer an extreme egalitarian wage policy over an extreme median-biased policy, if their loss is sufficiently modest thanks to the domino effects and if their equity concerns are sufficiently strong. Rewriting inequality 15, reveals that the critical condition is given by

$$\alpha' > \underline{\alpha} \equiv \lambda - \frac{(1 - \beta) \cdot (1 - \lambda) \cdot r}{\frac{1}{1-\lambda} \cdot \beta \cdot S - r},$$

where $r < \frac{1}{1-\lambda} \cdot \beta \cdot S$ (since $w_{eh}^H < w_{el}^H$). The following result is immediate:

Corollary 1. *Even a slight weakening of the median worker's equity concerns (from any level above $\underline{\alpha}$ to any level below) may result in a substantial reduction of the wage share and a substantial increase in wage inequality.*

In Sweden, the blue-collar union members' support for an egalitarian wage policy actually has decreased somewhat during the last decades.[36] It is thus conceivable that a change in the union members' preferences for equity may have contributed to the increase in wage inequality as well as the reduction of the wage share observed during the last decades.

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[36]This is documented in recurrent surveys (LO, 2011b).

6 Extensions

6.1 Unemployment

Part of the reason why egalitarian wage policies attract so much attention is their effects on unemployment. This section demonstrates that while unemployment may reduce the incentives for an egalitarian wage policy, such a policy may still be preferred.[37] I also show that unemployment may weaken the "domino effect." That is, increasing the lowest wage increases wages higher up in the distribution, but by a smaller amount.

High wage-costs may cause unemployment for at least two reasons. First, there may be a fixed number of identical firms operating under decreasing returns to scale. Then, wage costs may be too high for "marginal jobs" to be viable. Second, there may be free entry with increasing entry costs as more firms enter. Entry costs may increase either because heterogenous firms enter in order of efficiency or because of inelastic supply of some necessary "entry resource." In any case, wage costs may be too high for "marginal firms" to be viable.

A model with increasing entry costs   Consider the following entry model. There is a mass μ of potential firms and entry costs are distributed according to some cumulative distribution function $F(c)$. Firms enter and hire workers in order of efficiency. Considering an equilibrium with $v^H - w^H > v^L - w^L$, the most efficient firms hire A-workers and the marginal firms hire B-workers. The least efficient firm entering the market has entry cost $c = v^L - w^L$.[38] If $1 - \lambda \leq \mu \cdot F\left(v^L - w^L\right) \leq 1$, there is full employment among the A-workers and the employment rate among the B-workers is given by $\varphi\left(w^L\right) = \left[\mu \cdot F\left(v^L - w^L\right) - (1 - \lambda)\right] / \lambda \leq 1$ with $\varphi'\left(w^L\right) = -\mu \cdot F'\left(v^L - w^L\right) / \lambda \leq 0$.

Assuming that workers must choose whether to search for L- or H-jobs, the A-workers' incentive compatibility constraint is given by

$$ w^H - d_A^H \geq \left(w^L - d_A^L\right) \cdot \varphi\left(w^L\right). $$

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[37] When the employers have a great deal of monopsony power and wages are set below the B-workers' reservation level, an egalitarian wage policy may actually reduce unemployment. (Computations may be obtained from the author upon request.) These mechanisms may be part of the reason for the mixed empirical evidence on the employment effects of (collectively negotiated) minimum wages. Katz and Kreuger (1992), Card (1992a, b) and Card and Kreuger (1993) point at cases when increased statutory minimum wages increased employment of B-workers. Neumark and Wascher (1992) show that the effects may be positive in the short run and negative in the long run. In countries where minimum wages are determined through collective negotiations, the minimum wages appear to be higher but also more differentiated with respect to age, seniority and occupation. The effects on employment may well be different there. Skedinger (2006) finds relatively large adverse effect, using Swedish data. The most encompassing survey of the empirical literature concludes that most of the evidence indicates adverse effects (albeit not always statistically significant). There is, however, substantial variation between different studies and the mechanisms are still unknown (Neumark and Wascher, 2007).

[38] Assuming that the firms hiring B-workers cannot easily reorganize to hire A-workers, there is no competition for A-workers after firms have entered.

For low wages, $\varphi = 1$ and the new incentive constraint coincides with the old. For high wages, $\varphi = 0$ and the new incentive constraint coincides with the A-workers' individual rationality constraint. For intermediate wages, the new incentive constraint is between the old incentive constraint and the individual rationality constraint.

For additional concreteness it may be assumed that the B-workers' employment rate is given by $\tilde{\varphi}\left(w^L\right) = 1 - \vartheta \cdot \frac{w^L - d_B^L}{v^L - d_B^L}$. Note that $\vartheta \geq 0$ indicates the sensitivity of employment to wage cost and that employment is inelastic if entry cost variability is large.[39] Then, the new incentive compatibility constraint coincides with the old one for all wages up to $w^L = d_B^L$. Beyond that point, the new incentive constraint is first increasing and then decreasing. If the wage elasticity of employment, ϑ, is low enough the incentive constraint is increasing for all $w^L \leq v^L$ as described in figure 6.

Figure 6: Unemployment
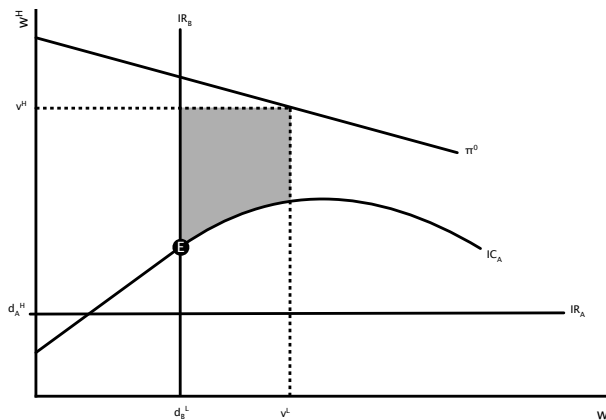
A model with decreasing returns to scale The same model can be reinterpreted to represent decreasing returns to scale at the level of the firm. In this case, it is assumed that each job in the firm is associated with some cost and that the additional cost of a job is increasing in the number of jobs that the firm has already opened. Now $F\left(c\right)$ represents the share of jobs in the firm with a cost below c.

Results Clearly, taking unemployment into account reduces the incentives for strategic delegation. The first reason is that the incentive compatibility constraint is weakened. For a given w^L, efficiency can be achieved at a lower w^H. The second reason is that the B-workers' interest in increasing their own wage is weakened by unemployment. It is easy

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[39]This functional form can be motivated the following way. Assume that entry costs are uniformly distributed on the interval $[k - s, k + s]$ where k is the expected entry cost. Entry costs may be negative if firms earn positive profits in other markets. The number of firms and employment is given by $\Gamma = \int_{k-s}^c \frac{\mu}{2s} \cdot dz = \frac{\mu}{2s} \cdot (c - k + s)$. The B-workers' employment rate is given by $\varphi = \frac{\Gamma - (1 - \lambda)}{\lambda} = \xi \cdot \left[v^L - (k - s) - \xi^{-1} \cdot \frac{1 - \lambda}{\lambda}\right] - \xi \cdot w^L$ where $\xi = \frac{\mu}{2s\lambda}$. If $k = \left(v^L - d_B^L\right) - \frac{s}{\mu} \cdot (2 - \mu)$, then $\varphi = 1 + \frac{\mu}{2s\lambda} \cdot \left(d_B^L - w^L\right)$. Letting $\frac{\mu}{2s\lambda} = \vartheta \frac{1}{v^L - d_B^L}$ delivers the desired result.

to see that A-workers would not engage in strategic delegation if the wage elasticity of employment, ϑ, is high enough.

For ϑ low enough, all the previous propositions remain valid. If the employers can set wages unilaterally, both the A-workers' incentive compatibility constraint and the B-workers individual rationality constraint bind. Then, the equilibrium wage structure is given by $w^L = d_B^L$ and $w^H = d_A^H + \left(w^L - d_A^L\right) \cdot \varphi\left(w^L\right) = d_A^H + r$, as before. This equilibrium is illustrated by the E-dot. Increasing a union's bargaining power, assuming the union representative to maximize the wage for H-jobs, leaves the equilibrium wage schedule at the E-dot, since the (direct) bargaining premium simply replaces the efficiency wage premium. Assuming the union representative to maximize B-workers expected utility $\left(w^L - d_B^L\right) \cdot \tilde{\varphi}\left(w^L\right)$ and increasing union bargaining power moves the equilibrium wage schedule up along the incentive compatibility constraint, increasing both wages. Thus, whenever the union's bargaining power is not too high, the A-workers prefer an egalitarian wage policy.

There is one new feature. The more bargaining power the union has, the higher are wages and (more interestingly) the lower is the wage difference in absolute terms. The reason why the wage difference decreases with increased union power is that the slope of the incentive compatibility constraint is lower than unity, i.e.

$$\frac{dw^H}{dw^L} = \varphi + \left(w^L - d_A^L\right) \cdot \varphi' \leq 1,$$

with strict inequality in case there is some unemployment among the B-workers.

6.2 Other rationales for efficiency wage-differentials

The key property of this part of the model is that the firm's output is increased from a low level to a high level if the wage difference between L- and H-jobs exceeds a threshold. In particular, the A-workers incentive-compatibility constraint entails that output is given by $\lambda \cdot v^L + (1 - \lambda) \cdot v^H$ whenever $w^H - w^L \geq d_A^H - d_A^L$. Otherwise output is only v^L.

The model assumes that this positive relation between firm productivity and wage differences arises as a result of adverse selection and screening. An example is that firms may use wage differences based on formal education to identify worker types and to inspire A-workers to invest in education (Spence, 1973).[40] Similarly, firms may use wage differences based on job requirements to induce their A-workers to volunteer for jobs with less desirable characteristics in terms of location, safely or cleanliness.

But similar and formally equivalent relations between firm productivity and wage

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[40]Assume that workers with basic education produce v^L while workers with advanced education produce v^H. Assume also that the A-workers have a lower cost of schooling. If firms condition wages on formal education and if the wage difference is large enough, the A-workers have an incentive to choose the longer education.

differences could arise for many different reasons, e.g. moral hazard. When it is difficult or expensive for firms to quantify individual output, but ranking workers is easy, a rank order tournament may be an efficient way to compensate labor (Lazear and Rosen, 1981). Tournament theory suggests that firms promote and pay a premium to some senior workers as a 'prize' to those who put in the most efforts.[41]

According to the "sociological" foundations of efficiency wages, a worker's wage is valued both for its purchasing power and for the relative status it implies. If status-conscious A-workers express their dissatisfaction with a relative wage compression by reducing work effort, firms may find it in their profit-maximizing interest to increase the A-workers' wages when the lowest wages are increased, in an attempt to restore work effort (Grossman, 1983).

7   Concluding remarks

A survey of the economic theory of trade unions concluded that the fundamental weak spot of this theory is our understanding of the unions' goals and how these goals relate to both the institutional structure of the unions and to the collective bargaining process itself. Even if an obvious goal is to maximize the wage bill, the classic question "Whose wage bill?" is still left without an answer (Kaufman, 2002, pp. 146-149). The empirical literature suggests that unions have egalitarian preferences. And also the union rhetoric supports this view. The present paper indicates that the conflict between workers may have been exaggerated. Fighting for the lowest wages may be an efficient union strategy to increase the wages of all their members.

Moreover, in a companion paper, I demonstrate hat the decisions by workers of different skills to unite to form industry unions is closely linked to the egalitarian wage policies that such unions pursue.

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[41]Standard moral hazard (Shapiro and Stiglitz, 1984) gives rise to similar effects if it is more important or difficult to monitor effort in some jobs than in other jobs. In the present model, the difficult-to-montitor-jobs are called "H-jobs" and they constitute the share $1 - \lambda$ of all jobs. Then, even if all workers are identical, those who have the H-jobs must be paid a premium, which they loose if they are reduced to the ranks, possibly in some other firm, after being caught cheating. While this would not constitute an optimal punishment, it seems reasonable to assume that also people who are fired may find easy-to-monitor jobs in other firms.

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A   Proof that employers induce the efficient outcome

Let $w_{IC}^H \left(w^L \right) = d_A^H + \left(w^L - d_A^L \right)$ be the lowest wage w^H that satisfies the IC_H-constraint for a given w^L. Similarly, let $w_{IC}^L \left(w^H \right) = d_A^L + \left(w^H - d_A^H \right)$ be the lowest wage w^L that satisfies the IC_H-constraint for a given w^H. In the following figure, the diagonal line is part of the IC-constraint. The figure shows the hiring outcome of every possible wage schedule. In region B, all wage schedules induce the A-workers to take on L-jobs and the B-workers to remain unemployed, and so on.

Figure 7: Hiring outcomes
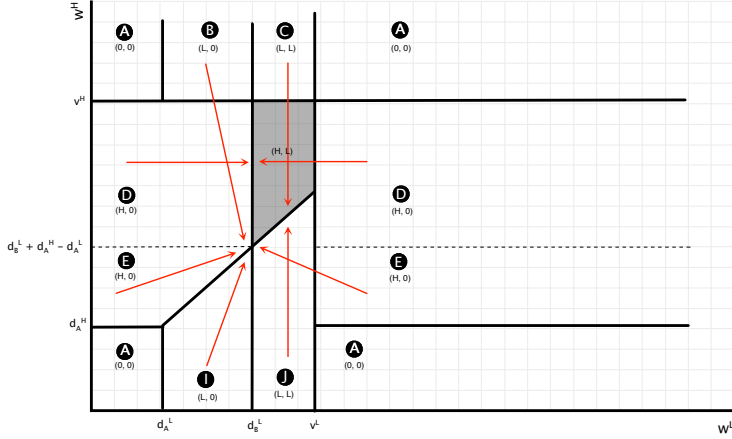
Area A Any wage schedule in any of the four areas marked by A, implies that no one will work. Clearly a change to any wage schedule in the interior of the shaded region benefits all workers and the firm at the same time.

Area J Consider any (w^H, w^L) such that $w^L \in [d_B^L, v^L]$ and $w^H < w_{IC}^H(w^L)$. Such a wage schedule implies that both types of workers are hired in L-jobs. Then, a switch to $(w_{IC}^H(w^L), w^L)$ is Pareto sanctioned. The B-workers apply for and will be hired in L-jobs in both cases. Thus, they are unaffected by the change. The A-workers will switch from L-jobs to H-jobs. The change in their utility is given by $(d_A^H + (w^L - d_A^L) - d_A^H) - (w^L - d_A^L) = 0$. Since the change increases the total surplus and since the workers surplus unchanged, the firm must gain.

Area C Consider any (w^H, w^L) such that $w^L \in [d_B^L, v^L]$ and $w^H > v^H$. Such a wage schedule implies that both types of workers are hired in L-jobs. (The A-workers would prefer a H-job, but such jobs are not offered.) Reducing the wage for high jobs to $w^H \in [d_A^H, v^H]$ implies that the A-workers will be in H-jobs instead. Such switch does not affect the B-workers. The A-workers do not lose if $w^H - d_A^H \geq w^L - d_A^L$. The firm does not lose if $v^H - w^H \geq v^L - w^L$. If the wage is set to make the A-workers indifferent, i.e. $w^H = w_{IC}^H(w^L) = w^L + d_A^H - d_A^L$, the firm will gain since $v^H - d_A^H \geq v^L - d_A^L$.

Area D Any wage schedule (w^H, w^L) in area D is Pareto dominated by (w^H, d_B^L). The workers' welfare are unchanged, but the firm gains.

Area E All wage schedules (w^H, w^L) in area E imply that the A-workers are hired in H-jobs while the B-workers are unemployed. Consider the alternative wage schedule $(w_{IC}^H(d_B^L), d_B^L)$. This wage schedule implies that the B-workers start to work in L-jobs

while the A-workers remain in H-jobs. The B-workers utility is unaffected, since they are paid their reservation wage. The A-workers are better off since their wage is increased.

The employer prefers the efficient outcome if

$$\lambda \cdot \left(v^L - d_B^L\right) + (1 - \lambda) \cdot \left(v^H - \left(d_A^H + d_B^L - d_A^L\right)\right) \geq (1 - \lambda) \cdot \left(v^H - w^H\right).$$

The worst-case scenario for the employers is if $w^H = d_A^H$ before the change. Then the employers prefer the efficient outcome if

$$\lambda \cdot \left(v^L - d_B^L\right) + (1 - \lambda) \cdot \left(v^H - \left(d_A^H + d_B^L - d_A^L\right)\right) \geq (1 - \lambda) \cdot \left(v^H - d_A^H\right),$$

i.e.

$$\lambda \cdot \left(v^L - d_B^L\right) \geq (1 - \lambda) \cdot \left(d_B^L - d_A^L\right).$$

The requirement is that the B-workers create a surplus that is larger than the efficiency wage premium earned by the A-workers, i.e.

$$\lambda \cdot \left(v^L - d_B^L\right) \geq (1 - \lambda) \cdot \left(d_B^L - d_A^L\right)$$

This is simply condition equation (10).

Area I   A similar argument as in the case of area J demonstrates that all wage schedules in area I are Pareto dominated by increasing w^H to $w_{IC}^H \left(w^L\right)$. The same argument as in the case of area E demonstrates that all these wage schedules are Pareto dominated by increasing the wage in L-jobs to $\left(w_{IC}^H \left(d_B^L\right), d_B^L\right)$, if and only if equation (10) is satisfied.

Area B   A similar argument as in the case of area C demonstrates that all wage schedules in area B are Pareto dominated by decreasing w^H to $w_{IC}^H \left(w^L\right)$. The same argument as in the case of area E demonstrates that all these wage schedules are Pareto dominated by increasing the wage in L-jobs to $\left(w_{IC}^H \left(d_B^L\right), d_B^L\right)$, if and only if equation (10) is satisfied.