The Effects of Redistribution on Productive Efficiency: The Cases of Unions and of Fiscal Burden*

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Abstract

The paper proposes a theoretical framework to analyze the contribution of the trade unions in the compensation schemes. The tendencies, observed in unionized sectors, towards compression of wages and towards an earning profile increasing with seniority are set into an equilibrium model. The driving force leading the unions to pursue the aforementioned wage structure is examined, and the three hypotheses of union benevolent with respect to all workers, benevolent with respect to its members, and ruled by the median worker are tested in various contexts that differ according to the outside option that the workers face. Some implications are then derived, regarding the redistribution operated by the union within a cohort and in favor of senior workers, and the effects of unions on productive efficiency and unemployment level[1].

1 Introduction

The traditional neoclassical framework analyzes a frictionless labor market displaying the tendency of earnings to the marginal productivity of the match between worker and job. The present work, instead, examines the influence of a friction, in the form of trade unions, regarded as institutions acting as intermediaries between the employers and the workers, and imposing relevant constraints on the bargaining game played by the actors. Specifically, the paper focuses on the effect of unions on wage dispersion and flexibility, and, consequently, on productive efficiency and unemployment.

Dispersion and rigidity/flexibility are two fuzzy concepts that are often interchanged. Therefore, a precise definition of what each of them is meaning

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in this paper is useful, and is provided next. The dispersion is the variance of the wages within a sector. In general, the main sources of earnings heterogeneity may lie in differences in the required skill and competence, in seniority, either in the current position or in the current industry, or finally in individuals' bargining ability. The rigidity is referred to as a property of the wage structure implying automatic adjustments of the salary, diplaying little no correlation to the situation of the market and the evoultion of personal skills. Usually, rigidity is intended either as the lack of reaction, in terms of wages or of employment, to exogenous shocks, or as a mechanism of steady increase of wages with seniority. The latter description is the one used in the following.

Freeman (1980) points out that unions affect dispersion both within-industry and across-industry. In his research on the American labor market, he finds that the application of union wage policies designed to standardize rates within and across esablishments significantly reduces wage dispersion among workers covered by union contracts, and that unions further reduce wage dispersion by narrowing the white collar/blue collar differential within establishments. Furthermore, the study shows that these effects dominate the impact of unionism on the dispersion of average wages across industries, so that on net unionism appears to reduce wage dispersion or inequality in the United States. His findings hold *a fortiori* for all the countries featuring strong unions and centralized bargaining covering all the industries, such as most of the European countries. This is confirmed by a number of studies, such as Hibbs and Locking's (2000) and Agell and Lommerud's (1992). The decision by workers to join the union has been a problematic issue. Under a squeezed wage schedule, the incentive for low-productivity workers to join is clear. However, why would high productivity workers, who apparently do not benefit from that institutional arrangement, do not opt out of the union, bargaining directly with their employer? The literature has provided essentially two answers. One (see Agell and Lommerud) attributes the choice to an insurance mechanism for agents who are uncertain about their future level of productivity; the other regards the adhesion to unions as necessary given some institutional environments of strong unions, and regulated central bargaining. The latter interpretation excludes the optimality of the union system, and considers it either as a merely temporary solution, or alternatively as a permanent one supported by prevailing vested interests. Hibbs and Loking, in this line of thought, claim that Swedish workers were largely against central union bargaining, which has, nevertheless, been imposed by law for a significant time period. An alternative explanation, developed in the paper, views the trade unions as agents of principals whose bargaining ability is not necessarily correlated with their own productivity. In other words, skilled but shy workers are better off in the union system.

Rigidity and significant redistribution towards the elderly triggered by the unions is commonly assessed by sociologists and political scientists. Freeman and Kleiner (1990) stress unions' positive effects on seniority protection, and their consequent negative effect on employment in the protected sectors. Why would then young workers choose to enter the union system? The answers are similar answers to those provided for the case of skilled workers.

In essence, unions engage in a redistributive operation, favoring unskilled and senior workers, at the expenses of the more productive and younger ones.

While the benefits triggered by a more egalitarian society *per se* are generally reckoned, the opportunity of imposing the reallocation of resources through mechanisms different than those provided by the market is disputed. The economic analysis on this issue essentially investigates the trade off between the benefits of redistribution in terms of increased social utility and the distortionary costs entailed by the distortions in agents' behavior related to redistribution. A rich body of research has been devoted to the identification of the optimal level of redistribution within a normative economic perspective. However, philosophical and political arguments overlap with the merely economic considerations. Mainly, the borders of individual freedom *vis à vis* institutions compelling citizens to renounce a fraction of their wealth is questioned. Coupling these issues with objective difficulties in measuring social and individual welfare, fostered by the arbitrariness in estimating, hence in gauging, the different utilities, a variety of positions has emerged on the most appropriate degree of redistribution, if any, that should arise through political, economic, or legal institutions.

Notwithstanding these differences, it is quite commonly assessed that politics should provide for the reallocation of a portion of ressources. The States dispose of a number of instruments for that purpose. Traditionally, fiscal burden has been regarded as one of the most suitable mechanisms, and, in spite of some recent theoretical results that show the impossibility of producing a non-perverse redistribution in the presence of multiple dimensions and under certain conditions (see Austen-Smith and Wallerstein, 2003), empirical observations of the effects of reallocation through fiscal burden seem to display the tendency for it to move in the desired direction. Wages contracts signed within an unionized system, feature the previously outlined characteristics, are also deemed to represent a valid and extensively adopted mean. Differently than fiscal burden, though, trade unions are not directly controlled by the State, which, except for specific circumstances, may at most design mechanisms to incentivate, or alternatively to deter, unionization; furthermore, while the States distributes *ad libitum* the fiscal revenues, it is not generally entitled to intervene in the wage setting operated by the trade unions.

The idea of the paper is the following. Starting from the observed intermediate objective of the unions, which consist in suizzling wages and enhancing rigidity, I guessed a number of objective function for the union, which appeared to me plausible. Then, I constructed a stylized model of wage setting employing these objective functions. I then verified that the predictions of the model matched with the aforementioned empirical observations. I finally derived some implications of how much redistribution unions entail, and on the resulting values of productive efficiency and of unemployment. The insights that the model might offer therefore consist in a specification of the unions' real objective compatible with the observable intermediate objectives, and in the derivations of results about productive efficiency and unemployment in a variety of institutional context characterized by different degree of pervasiveness of the union system.

Some salient features of the model of redisitrubution through trade unions are now presented. Unions are assumed to operate in a perfectly competitive labor market; the bargaining power of the firms, whose outside option is the null profit, is thus reduced, in line with the neoclassical theory predictions. As a consequence, unions hold a significant share of the bargaining power in this environment. Unions set the retributions for the various occupations, and manage to design optimal contracts. They construct a menu prescribing the wage for each activity exerted. Firms are assumed to be able to monitor perfectly their workers, following Saez (1996); therefore, workers choose an activity, knowing for each occupation the pair of effort required and compensation awarded, and cannot shirk on the workplace. This assumption is fundamental to derive the effects of unions on the workers' productivity choices. Some frictions, such as heterogeneity in workers' bargaining ability, are then introduced, with the effect of shifting workers' outside option. Finally, an alternative assumption about the unions' governance - the standard median voter - is envisaged, and the robustness of the findings of the basic scenario is checked in this environment.

2 The model

This section is devoted to the exam of the set up of the model for the redistribution of utility, and for the reduction of dispersion in wages, generated by the presence of trade unions, and its effect on the total productivity.

Each workers is endowed with a level of non-specific human capital, λ. This assumption can be justified by assessing either that education does not affect workers' productivity, or, alternatively, that human capital cannot increase since the worker's entry in the labor market. Both these possible explanations imply that human capital is exogenous in the model. λ can be regarded as the maximal productivity that each worker is able to achieve on the jobplace. It is uniformly and randomly distributed across workers on a set of measure 2, stretching from 1 to 3. A continuum of possible occupations is available for the workers to choose from, each characterized by a required level of constant marginal productivity θ, perfectly monitored by the firm. These occupations θ are located on a continuous interval of measure 3, ranging from 0 to 3. A wage is associated to each level of occupation-productivity θ. Each worker selects an occupation to maximize his utility function. The utility specification is identical across workers, the only source of heterogeneity being represented by λ. The utility level is positively correlated to the wage $w(\theta)$ and negatively correlated to the effort $e(\theta, \lambda)$. The effort, in its turn, is positively related to the level of occupation θ, and negatively related to the level of human capital λ. The positive relation between the effort e and θ is intuitively clear if we think of θ as measuring the productivity of the worker on the jobplace, perfectly monitorable by the firm: the most the worker has to be productive on the job, the highest effort he has to exert; the negative relation between e and λ, instead, can be interpreted as indicating that, *ceteris paribus,* workers endowed with a higher human capital have to exert less effort to achieve a determined level of productivity θ. The level of occupation-productivity each worker chooses, θ, has to be lower than its human capital endowment λ. This restriction can be easily understood by recalling that λ may be also viewed as a measure of the maximum possible productivity achievable by a worker. The parameter λ affects the value function $V(\lambda)$ both directly, and indirectly through the choice variable $\theta(\lambda)$. The form of the utility function implies that in the neoclassical framework, in which workers are paid their marginal product, it is optimal for workers to exert their maximal effort, choosing $\theta = \lambda$. The chosen utility specification encompasses the previously illustated features, furthermore being concave in wages and linear in effort:

$$U(w, e(\theta, \lambda)) = \left\{ \begin{array}{c} \log w - \frac{\theta}{\lambda} + 1 \Leftrightarrow \theta > 0 \\ 0 \Leftrightarrow \theta = 0 \end{array} \right\} \tag{1}$$

If workers' outside option is null, i.e., if the utility when they do not work is 0, all of them in this framework choose to work. Indeed, the introduction of the constant additive term of 1 achieves voluntary participation by the totality of workers. This term should be interpreted as a constant utility which all workers derive from the fact of working, rather than a reserve utility achieved regardless of whether or not workers do work. Its most meaningful economic interpretation is in my view the following. In an environment in which unemployment arises exclusive on a voluntary basis, there may exist incentive mechanisms to stimulate individuals to work; an example of one of them may consist in the award of a benefit, with the effect of a one unit increase in the utility, for the individuals who choose to work, no matter the level of effort they exert. In the neoclassical benchmark, all workers exert the maximal effort on the workplace; therefore, productive efficiency is accomplished.

In the unionized environment, wages are bargained by the trade unions, who act as intermediaries.

I assume the existence of a single union. The specification of the union's objective function, as discussed in the introductory sections, is a controversial issue. The assumptions of the model help solving the issue, as the presence of a single union bypasses difficulties in identifying the specific target of union's action, which here is represented by the whole set of workers, while the absence of involuntary unemployment solves the issue of whether or not unions care about unemployed. As a consequence, the union in this model, in the basic version, maximizes the total utility of all workers, constrained both by the willingness of keeping all the workers within the union, and by the requirement that average wages *ex post* do not exceed average productivity. The first constraint is actually an equilibrium result, which will be proved to hold. It results from union's priority of preventing the emergence of perverse adverse selection effects, which would ultimately generate a breakdown in the system[2]. The imposition of the second condition insures that firms earn non-negative profits, and thus they do not shut down. The argument can be extended to all firms because of the assumption of homogeneity of the distribution of workers' types across firms.

[2] A formal proof is provided in **??**.

Workers are not constrained to be part of the union; if they wish to, they can bargain directly with the employers. In the basic version of the model, examined in the next section, I assume for expositional ease, that, in this case, they obtain their benchmark wage equal to their marginal productivity, but pay an *una tantum* cost C, constant across types. This cost is reflected in the single period utility function in the cost c, which can be interpreted as the spread of the overall cost on every single period. The rationale for this structure of the outside option lies in the fact that the institutional environment, rather than individual characteristics, determine the entity of the cost of quitting the union.

Firms in equilibrium hire all the workers and do not fire them, and accept to pay workers committing to a level of productivity θ the amount specified in the wage menu set up by the union. The thread of the argument is the following. Firms are distributed an ε profit in the unionized system. Their profit would be zero in the alternative individual bargaining hypothesis. If firms deviated, refusing to employ low skill unionized worker, they would have positive profit for the first period, but in subsequent periods the unionized system would collapse, thus generating the punishment of zero profit forever. As long as the discount rate is high enough, the deviation is not profitable, and the whole structure works[3]. Also, I maintain that the distribution of workers' types, or equivalently of productivity choices, is the same across firms. The perfect monitoring on workers' productivity by the firms suppresses for the former the option to shirk.

Wages are set as a result of a two-stage game. The union moves first, determining a wage schedule for each level of θ. Then, workers choose θ given their type λ and the offered wage schedule.

Finally, I adopt the simplifying assumption that union's set of feasible contract is restricted to the linear ones, of the form

$$w_i = a + b\theta_i$$

3 Solution of the model

The section is devoted to the solution of the two stage game between workers and union to set the menu of wages for the various productivity choices made by the workers.

Proposition 1 *The optimal linear contract specifying the menu of wages results from the following maximization problem solved by the unions:*

$$\max_{a,b} \left(\frac{3}{2} + \frac{a}{2b}\right) \log 3 + \log b - 1 \tag{2}$$

[3] A formal proof is provided in **??**.

subject to the four following constraints:

$$
\begin{aligned}
2b - 2 + \frac{a}{b} &\leq 0 \quad (3)\\
\log b + \frac{a}{3b} &\geq -c \quad (4)\\
a &\geq 0, b \geq 0 \quad (5)
\end{aligned}
$$

Proof. To solve the problem, I employ the standard backward induction procedure to solve multiple-stages games.

In the second stage, workers maximize their utility over the choice of occupation, which is the only variable they can control for, taking a and b, determined by the bargaining activity of the union, as given:

$$\max_{\theta} U\left(w, e\left(\theta, \lambda\right)\right) = \log\left(a + b\theta\right) - \frac{\theta}{\lambda} + 1 \quad (6)$$

such that $0 \leq \theta \leq \lambda$, yielding the following optimality expression:

$$\frac{b}{a + b\theta} = \frac{1}{\lambda} \Leftrightarrow \theta = \lambda - \frac{a}{b} \quad (7)$$

under the condition that:

$$\lambda \geq \frac{a}{b} \geq 0 \quad (8)$$

8 is justified by the assumed condition $0 \leq \theta \leq \lambda$, guaranteeing that workers choose an occupation with a required positive level of productivity, however lower than their maximal achievable level of productivity λ. Since this optimal reaction of workers to the wage menu set by unions has to hold for all of them, it can be more generally restated as:

$$\theta_i = \lambda_i - \frac{a}{b} \quad (9)$$

under the conditon 8. Also 8 has to hold for all types λ. However, the satisfaction of the constraint for the smallest λ implies its satisfaction for all the bigger values of λ. As a consequence,

$$a \leq b \quad (10)$$

In the first stage, the union chooses a and b accounting for workers' reaction in terms of chosen activity:

$$\max_{w(\theta)} \int_1^3 U\left(w\left(\lambda\right), e\left(\lambda, \theta\right)\right) f\left(\lambda\right) d\lambda \Leftrightarrow \max_{a,b} \int_1^3 \left(\log\left(a + b\theta_i\right) + 1 - \frac{\theta_i}{\lambda}\right) \frac{1}{2} d\lambda \quad (11)$$

under the following constraints:

$$
\begin{aligned}
\int_1^3 \left(a + b\theta_i\left(\lambda\right)\right) \frac{1}{2} d\lambda &\leq \int_1^3 \theta_i\left(\lambda\right) \frac{1}{2} d\lambda \quad (12)\\
\log \lambda_i - 1 - c &\leq \log\left(a + b\theta_i\right) - \frac{\theta_i}{\lambda_i} \forall i \quad (13)\\
\theta_i &= \lambda_i - \frac{a}{b} \quad (14)
\end{aligned}
$$

where 12 is the resource constraint and 13 is the incentive compatibility constraint that keeps all the workers inside the unions.

After substituting for the optimal reaction, the problem becomes:

$$\max_{a,b} \int_1^3 \left(\log(b\lambda) + \frac{a}{b\lambda}\right)\frac{1}{2}d\lambda \tag{15}$$

under the following constraints:

$$\int_1^3 (b\lambda)\frac{1}{2}d\lambda \leq \int_1^3 \left(\lambda - \frac{a}{b}\right)\frac{1}{2}d\lambda \tag{16}$$

$$\log\lambda - 1 - c \leq \log(b\lambda) - 1 + \frac{a}{b\lambda}, \forall\lambda \tag{17}$$

17 can be simplified to obtain

$$-c \leq \log b + \frac{a}{b\lambda} \tag{18}$$

18 has to hold for all λ. If it did not hold for a single λ, the constraint imposing to the union to keep all workers within it would not be satisfied. Since

$$\frac{\partial\left(\log b + \frac{a}{b\lambda}\right)}{\partial\lambda} < 0$$

and the constraint requires $\log b + \frac{a}{b\lambda}$ being bigger than a constant, the satisfaction of the constraint for the highest admissible value of λ implies the satisfaction of the constraint for all the admissible values of λ. Therefore, setting $\lambda = 3$, and solving the integral, we obtain the desired result. ■

The previous result is based on the assumption that the union is willing to keep all the workers within it. Intuitively, such willingness arises for two different reasons for the two types of workers. For high productivity workers, the union avoids the emergence of adverse selection mechnanisms, while for low productivity workers the assumption of total workers' utility maximization drives the result. Formal proofs are provided in the next section.

4 Results

4.1 Null outside option

The results of the model are crucially related to the nature and the entity of the outside option. The first result is computed by interpreting the cost as impossibility of working outside the union. The workers have a null outside option, which translates into a participation constraint for the workers. If we are willing to regard the term $\frac{\theta}{\lambda}$ included in the workers' utility as encompassing the opportunity cost of working, the definition of the participation constraint in term of the requirement of non-negative utility for each worker, or, in other terms, of individual rationality, makes sense. On the economic ground, the null outside option can be regarded as a norm imposing the employers to pay all the workers the wage established by the union. It may also approximate the situation of many highly regulated countries, in which centralized bargaining determines the wage setting for all the sectors. Alternatively, it may be regarded as stemming from the workers' absolute inability in bargaining.

Proposition 2 *When the union is constrained to keep all workers within it, and workers' outside option is null, the optimal contract signed by the union entails redistribution, and diminishes productive efficiency with respect to the non-unionized framework.*

Proof. The union maximizes

$$\max_{a,b}\left(\frac{3}{2}+\frac{a}{2b}\right)\log 3+\log b-1 \tag{19}$$

subject to the following constraints:

$$2b-2+\frac{a}{b} \leq 0 \tag{20}$$

$$\log\left(a+b\theta_i\right)-\frac{\theta}{\lambda}+1 \geq 0 \tag{21}$$

$$8 \tag{22}$$

$$a,b \geq 0 \tag{23}$$

21 can be written, after substituting for the workers' optimal reaction, as

$$\log\left(b\lambda_i\right)+\frac{a}{b\lambda_i}\geq 0,\forall\lambda \tag{24}$$

Since

$$\frac{\partial\log\left(b\lambda_i\right)+\frac{a}{b\lambda_i}}{\partial\lambda} \tag{25}$$

is positive if $\lambda>\frac{a}{b}$, which is required by 10, the satisfaction of the constraint for the smallest λ implies its satisfaction for all values of λ. Therefore, 24 can be written as

$$\log b+\frac{a}{b}\geq 0 \tag{26}$$

and the following is the problem that the union solves:

$$\max_{a,b}\left(\frac{3}{2}+\frac{a}{2b}\right)\log 3+\log b-1$$

subject to the following constraints:

$$2b-2+\frac{a}{b} \leq 0 \tag{27}$$

$$\log b+\frac{a}{b} \geq 0 \tag{28}$$

$$10 \tag{29}$$

$$a,b \geq 0 \tag{30}$$

At the optimum, $b = \frac{11}{12}$, while $a = \frac{11}{72}$.

Each worker chooses 9, which implies in this case

$$\theta_i = \lambda_i - \frac{\frac{11}{72}}{\frac{11}{12}} = \lambda_i - \frac{1}{6}$$

As a result, the average productivity put in place by all the workers is given by:$\int_1^3 \theta(\lambda)\, d\lambda = \int_1^3 \left(\lambda - \frac{1}{6}\right) \frac{1}{2} d\lambda = \frac{11}{6}$. Compared with the average productivity of 2 in the neoclassical framework, the redistributive activity carried on by the union in this scenario entails productive inefficiency. The average social welfare is given by:

$$\int_1^3 \left(\log\left(\frac{11}{12}\lambda\right) + \frac{1}{6\lambda}\right) \frac{1}{2} d\lambda = \frac{3}{2}\log\frac{33}{12} - 1 + \frac{1}{12}\log 3 - \frac{1}{2}\log\frac{11}{12} = 0.652\,46$$

The nonunion average utility is the following:

$$\int_1^3 (\log\lambda)\frac{1}{2}d\lambda = \frac{3}{2}\log 3 - 1 = 0.647\,92$$

■

The result illustrates the intuitively plausible trade off between social utility enhancement through redistribution and losses in productive efficiency.

To pursue the argument of the drawbacks of redistribution from a philosophical perspective, a computation of the maximal utility loss of each individual in thise environment, with respect to the neoclassical benchmark, is required. This number reflects the maximal individual freedom that an individual has to renounce as a consequence of the union intermediation. The individual with the maximal loss is the one with the highest human cpital endowment, given by $\lambda = 3$. His utility under the perfect competition benchmark amounts to 1. 098 6, while its utility under the benevolent union attains 1. 067 2 , for a net loss of 0.0314.

Redistribution hinges on the concavity of individual utility functions. What prevents the emergence of a flat rate is the *ex post* choice of effort by the worker, which originates the trade-off between redistribution and effort, common in the taxation, and more generally in the redistribution literature. If, instead, wages were anchored exclusively to skill, unions might be able to obtain the flat rate.

In the previous analysis, we assumed that the union is constrained to keep within it the totality of the workers. The next discussion is devoted to show that this choice is indeed optimal as long as workers' outside option is null. At first, we examine why the union would not prefer to get rid of high productivity workers.

Proposition 3 *As long as workers' outside option is null, for the union it is optimal to keep high productivity workers within it.*

Proof. Say that the union gets rid of the highest productivity worker. The maximization problem solved by the union is subject to the budget constraint and to the individual rationality constraint. The IR constraint has to be satisfied for the lowest value of λ, so it is unaffected by the modification. The budget constraint is stricter if lower productivity people work. Thus, the union is maximizing over a more limited set of people and over stricter constraints. As a consequence, the optimal contract signed by the union keeping only low productivity workers would have been achievable also in the benchmark situation, in which all workers are constrained into the union. Furthermore, all workers excluded by the union get a null utility. As a consequence, by a revealed preference argument, the union finds it optimal not to exclude high productivity worker. ■

An analogous conclusion can be reached by a standard adverse selection argument.

The following section discusses formally the optimality of the union's choice to include low productivity workers in it. For notational clarity, define OP the original version problem, in which the union is constrained by keeping all the workers within it, while define MP the modified scenario in which low productivity workers are left out. The argument proceeds by contradiction, assuming that the union gets rid of the low productivity workers, and subsequently showing that it is not optimal.

Proposition 4 *The objective function in MP is a special case of the objective function in OP, in which the values of utility for a class of workers is predeterminedly set to zero.*

Proof. The objecive function in OP is:

$$\max_{a,b} \int_1^3 \left(\log(b\lambda) + \frac{a}{b\lambda}\right) \frac{1}{2} d\lambda \tag{31}$$

It can be rewritten as

$$\max_{a,b} \int_{1+\varepsilon}^3 \left(\log(b\lambda) + \frac{a}{b\lambda}\right) \frac{1}{2-\varepsilon} d\lambda + \int_1^{1+\varepsilon} \left(\log(b\lambda) + \frac{a}{b\lambda}\right) \frac{1}{\varepsilon} d\lambda \tag{32}$$

The objective function in MP corresponds to the first term of the objective function of OP. However, since utility for left out workers in the interval $\lambda \in [1, 1+\varepsilon]$ is null, the MP can be written as:

$$\max_{a,b} \int_{1+\varepsilon}^3 \left(\log(b\lambda) + \frac{a}{b\lambda}\right) \frac{1}{2-\varepsilon} d\lambda + \int_1^{1+\varepsilon} 0 \frac{1}{\varepsilon} d\lambda$$

Thus, the objective function of MP is the same as the objective function in MP with a constraint that the value for the interval $\lambda \in [1, 1+\varepsilon]$ is set to zero. In other words, the OP is a more general objective function than MP; a result of the optimization procedure for OP can make it equivalent to MP, while the reverse is not necessarily true. ■

Lemma 5 *The IR constraint of MP does not change OP.*

Proof. The general form for the IR constraint is expressed by 24. Since

$$\frac{\partial \log(b\lambda_i) + \frac{a}{b\lambda_i}}{\partial \lambda} \tag{33}$$

is positive if $\lambda > \frac{a}{b}$, which is required by 10, the satisfaction of the constraint for the smallest λ implies its satisfaction for all values of λ. If low productivity workers are left out, then the value of λ required for 24 to hold increases. The effect of raising λ on the constraint, as just shown, raises the value of $\log(b\lambda_i) + \frac{a}{b\lambda_i}$, thus relaxing the constraint. However, in OP, IR did not bind. Therefore, OR and MP are equivalent according to the effect of IR. ■

Lemma 6 *The resource constraint of MP is stricter than its counterpart in OP.*

Proof. OP resource constraint is given by:

$$\int_1^3 (b\lambda)\frac{1}{2}d\lambda \leq \int_1^3 \left(\lambda - \frac{a}{b}\right)\frac{1}{2}d\lambda$$

In MP, it can be rewritten as:

$$\int_{1+\varepsilon}^3 (b\lambda)\frac{1}{2-\varepsilon}d\lambda + \int_1^{1+\varepsilon} 0\frac{1}{\varepsilon}d\lambda \leq \int_{1+\varepsilon}^3 \left(\lambda - \frac{a}{b}\right)\frac{1}{2-\varepsilon}d\lambda + \int_1^{1+\varepsilon} 0\frac{1}{\varepsilon}d\lambda$$

However,

$$\int_{1+\varepsilon}^3 (b\lambda)\frac{1}{2-\varepsilon}d\lambda + \int_1^{1+\varepsilon} 0\frac{1}{\varepsilon}d\lambda = \int_1^3 (b\lambda)\frac{1}{2}d\lambda$$

Intuitively, the average salary is the same whether it is distribued to all workers, or only to workers who actually work. Also,

$$\int_{1+\varepsilon}^3 \left(\lambda - \frac{a}{b}\right)\frac{1}{2-\varepsilon}d\lambda + \int_1^{1+\varepsilon} 0\frac{1}{\varepsilon}d\lambda = \int_{1+\varepsilon}^3 \left(\lambda - \frac{a}{b}\right)\frac{1}{2}d\lambda$$

Therefore, the budget constraint in MP is:

$$\int_1^3 (b\lambda)\frac{1}{2}d\lambda \leq \int_{1+\varepsilon}^3 \left(\lambda - \frac{a}{b}\right)\frac{1}{2}d\lambda$$

The left hand side is the same as in OP, while the right hand side is smaller. Therefore, the constraint is stricter. ■

Proposition 7 *As long as workers' outside option is null, it is optimal for the union to keep low productivity workers within it.*

Proof. Say that the union gets rid of the low productivity workers. In MP, the IR and the resource constraint are modified, while the conditions for a, b remain identical. However, we have proved that IR does not affect the problem, while the resouce constraint is stricter in MP than in OP. Also, the objective function in MP is a special case of the objective function in OP, with some values *a priori* set to zero. Therefore, the result obtained in MP are admissible, yet not chosen, in OP, while the results obtained in OP are not admissible in MP. By a revealed preference argument, we reached a contradiction, which implies that it is not optimal for the union to solve MP. ■

Summary 8 *As long as workers' outside option is null, the union acts optimally by keeping all the workers within it. Compared with the contracts signed in the non-unionized environment, the optimal contract setup by the union provides a higher level of redistribution, but lowers the level of productive efficiency. In reality, the assumption of a null outside option is likely to be hinged upon a set of norms that forbid any alternative wage setting mechanisms. The consequential deprivation of individual freedom can be approximated by the loss in terms of utility of each individual in this environment with respect to the unregulated economy.*

4.2 Positive outside option

Non specific human capital The analysis presented until now viewed the

outside option as exogenous. The following results, on the contrary, are based on the assumption that workers' outside option is endogenous, and varies across workers. The simplest case arises when workers' outside option is positively related to their productivity. Workers' human capital is in this case viewed as nonspecific, and the workers' productivity on the jobplace is reflected in their bargaining ability.

We start with the simplest assumption that higher productivity workers, denoted by λ^H (as opposed to the others, denoted by λ^L), such that $\lambda^H \in [1, 2]$, are able to bargain a contract specifying a wage equal to their marginal productivity, while the low productivity workers are not able to sign a contract, so that their outside option is null.

Proposition 9 *Under the above listed assumptions, the union finds it optimal to leave out high productivity workers, and solves the following maximization problem to specify the wage:*

$$\max_{a,b} \frac{1}{2} \log b + \left(1 + \frac{a}{2b}\right) \log 2 - \frac{1}{2} \tag{34}$$

subject to the following constraints:

$$\frac{3}{4}b + \frac{a}{2b} - \frac{3}{4} \leq 0 \tag{35}$$

$$\log b + \frac{a}{b} \geq 0 \tag{36}$$

$$a, b \geq 0$$

$$a \leq b$$

Proof. 36 follows from the already proved fact that the satisfaction of IR for the lowest value of λ implies its satisfaction for all values of λ if workers' outside option is null. 35 states that average productivity of workers of type λ^L has to equal their average wage. The exclusion of the high productivity worker is determined by the fact that their contract should specifiy for them a wage equal to their marginal productivity. Given the linear nature of the contract, it should have specified a similar wage equal to marginal productivity for low productivity workers, thus preventing the union from redistributing. If we are willing not to stick to the linear contract, we can envisage a contract specifying a wage equal to marginal productivity for high workers, and a wage equal to the solution to the maximization problem for the low workers. ■

The result of the optimization process provides for $a = \frac{29}{600}$ and $b = \frac{29}{30}$. The social welfare is given by the sum value function evaluated at the optimum and the utility of high productivity workers paid their marginal productivity.

$$\frac{1}{2}\log\frac{29}{30} + \left(1 + \frac{1}{40}\right)\log 2 - \frac{1}{2} + \int_2^3 (\log\lambda)\frac{1}{2}d\lambda = 0.193\,53 + \frac{3}{2}\log 3 - \log 2 - \frac{1}{2} = 0.648\,3$$

As intuitively clear, the social welfare is higher than in the nonunion case (since the union can redistribute among low productivity workers), and it is lower than in the null outside option (as the union cannot redistribute among highest productivity worker).

Low productivity workers choose $\theta_i = \lambda_i - \frac{a}{b} = \lambda_i - \frac{1}{20}$. Thus, the average productivity is given by:

$$\int_1^2 \left(\lambda - \frac{1}{20}\right)\frac{1}{2}d\lambda + \int_2^3 (\lambda)\frac{1}{2}d\lambda = 1.\,975$$

As expected, the average productivity in this environment, in which the redistributive activity of the union is limited to the low productivity workers, is lower than in the nonunionized, non redistributive environment, while it is higher than in the completely redistributive environment.

Corollary 10 *In an environment, in which $\lambda^H \in [x, 3]$ have an outside option equal to their marginal productivity, while $\lambda^L \in [1, x]$ have a null outside option, for any $x \in [1, 3]$, λ^H are optimally excluded by the benevolent union, and redistribution happens among λ^L. The highest x is, the highest the social welfare, the lowest productive efficiency.*

Proof. The proof is very similar to the one presented above, and it is only sketched here. The lowest x is, the least the union is constrained in its maximization problem, the most it can redistribute. A higher redistribution entails a higher distortion from the productive efficiency situation. ■

Remark 11 *The two extreme cases are of particular interest. When* $\lambda^H \in [1,3]$; *all the workers have an outside option equal to their marginal productivity, and the union cannot enhance social welfare through redistribution. When* $\lambda^H \in [1,3]$, *all workers' outside option is null. This case has been extensively discussed earlier.*

Summary 12 *In this case, the union acts as an agent of the workers, and it repairs a market imperfection. There is a number of workers, unable to bargain, who delegate this task to the union. There is no issue of deprivation of individual freedom in the present situation, since the union determines a gain for all the workers.*

Non specific human capital Next, we assume that human capital exhibited

in the workplace is specific and is uncorrealted with the bargaining human capital. The wage obtained for a given productivity choice θ has a uniform probability distribution on the interval $[\theta - \xi, \theta]$, $\gamma \in [0, \xi]$ being an inverse measure of the bargaining human capital. A low γ_i signals a high bargaining ability. Each worker knows exactly *ex ante* γ_i, and can predict the wage the firm will offer him if he decides to bargain directly with it. The firm gets to observe γ_i when the worker engages in the bargaining activity, and sets the wage accordingly. The union does not observe γ_i and constructs a menu of wages for each level of productivity to maximize the total utility of the workers. The union is constrained by the resource constraint that requires the average productivity *ex post* to equal the average wage for the unionized workers.

If a worker quits the union, he bargains directly with the employer, and sets his productivity choice θ by solving the maximization problem embodying, his bargaining human capital

$$\max_{\theta} \log(\theta - \gamma_i) - \frac{\theta}{\lambda} + 1$$

subject to the constraint $\theta \leq \lambda_i$. At the optimal solution, all workers who work choose $\theta = \lambda$ whatever their bargaining ability is, and are paid $\lambda_i - \gamma_i$.

The individual rationality constraint

$$\log(\lambda_i - \gamma_i) \geq 0 \tag{37}$$

implies that all workers for whom that $\lambda - \gamma \leq 1$, prefer not to work at all.

Analogously to the basic version, the union sets a and b, after which workers choose to stay in the union if their highest possible utility achievable within the menu of wages setup by the union exceeds their outside option, perfectly forecast by them *ex ante*, or if $\lambda_i - \gamma_i \leq \log(b\lambda_i) + \frac{a}{b\lambda_i}$

Proposition 13 *In this setup, the benevolent union enhances both productive efficiency and social welfare.*

Proof. In the non unionized case, all workers have to bargain with their employer. Their average social utility is given by an integral censored to its positive values:

$$\begin{cases} \int_1^3 \log\left(\lambda - \left(\int_0^\xi \gamma \frac{1}{\xi} d\gamma\right)\right) \frac{1}{2} d\lambda for \forall (\lambda, \gamma) : \lambda - \gamma \geq 1 \\ 0 otherwise \end{cases}$$

Assuming $\xi = 0.5$, the previous problem can be rewritten as:

$$\begin{cases} \int_1^3 \log\left(\lambda - \left(\int_0^{0.5} 2\gamma d\gamma\right)\right) \frac{1}{2} d\lambda for \forall (\lambda, \gamma) : \lambda - \gamma \geq 1 \\ 0 otherwise \end{cases} = 0.52671$$

$\frac{1}{8}$ of the workers do not work. They are concentrated, as previously mentioned, in the $\lambda \in [1, 1.5]$ interval. In particular, they represent half of this interval. The productivity of the individuals who decide to work in the aforementioned interval is characterized by the density function $f(\lambda) = -8 + 8\lambda$. Therefore, the overall average productivity, expressed as:

$$\frac{3}{4} \int_{1.5}^{3} \lambda \frac{2}{3} d\lambda + \frac{1}{4} * \frac{1}{2} \int_{1}^{1.5} \lambda(-8 + 8\lambda) d\lambda = 1.854\,2$$

is lower than the productive efficiency level, previously computed and equivalent to 2.

By setting a wage equal to the average productivity, or $a = 0$ and $b = 1$ the union can, in this scenario, enhance both the social welfare and the level of productive efficiency. Indeed, the budget constraint is trivially satisfied, since all workers are paid their marginal product, and 37 holds, since $\log \lambda_i - \gamma_i \leq \log \lambda_i$, being $\gamma_i \geq 0$. The average social welfare in this scenario, as previously computed, is 0.647 92; meanwhile productive efficiency is reached. ■

An interesting extension would be to examine whether the union could do even better than that in terms of social welfare by letting out workers with high bargaining ability, leaving the budget constraint unaffected, and by redistributing among workers of all productivity level, but with low bargaining ability, or among all λ and high γ. The specificity and uncorrelation of on-the-job and bargaining human capital allows to let out high bargaining ability workers without affecting the overall budget constraint, thus preventing the emergence of the adverse selection issue previously presented.

This result is interesting, in that it shows that in the context of this static partial equilibrium model productive efficiency does not optimize social welfare.

Summary 14 *In this context, the union is the perfect substitute for the market. Indeed, as a consequence of the imperfections due to the limited bargaining ability of a set of workers, the market does not allow to accomplish the perfect competition benchmark. The intervention of the union repairs the market imperfections, and allows this benchmark to be attained.*

5 Median voter analysis

Another common assumption in the union literature is that the organizations maximize the welfare of the median component of the association. This assumption stems from the fact that workers in the labor unions, and in this particular case the single labor union, vote to determine the exact policy that will be adopted, in this case they vote to determine the linear contract that unions will establish for their workers. The results in this section depend crucially on the possibility of observing λ.

5.1 Miopic voters

After having examined the compatibility between wage compression and benevolent unions, the paper presents a brief overhaul of the compatibility between redistribution through wages, and unions driven by the median worker. This case will be used to check the robustness of the results. I assume that voters are miopic, in the sense that they care only about the short term welfare, and they do not consider future implications from their choice for unions' behavior. In other terms, voters do not care about indirect effects on the unions' composition resulting from the workers' policy selection.

5.1.1 Null outside option

Back into the case of a null outside option, in which workers' only outside option is to choose not to work, thus getting a null utility, this situation differs from the previous one in the sense that the union not only signs a contract, but also it has the power to decide the level of productivity required to the workers to be able to adhere to the union contract. To start, the assumption is that the union is able to detect the ability of the workers λ, and as a consequence it can decide he set of workers who can exploit the union's contract on the basis of unobservables for the firm. In other words, the contract signed by the union not only specifies the wage for each level of effort, but also it indicates the set of workers who can work, and the set of workers who cannot (in this case of a null outside option). The following results depend on this assumption, which basically consists in the introduction of a new instrument of workers' selection within the contract.

Proposition 15 *The median voter chooses to exclude from the union all the workers with a lower human capital endowment than his own.*

Proof. The linear specification of the contract, $w_i = a + b\theta_i$, in which $a, b \geq 0$, conjugated with the satisfaction of the condition of non negative profit for the firm, and with the condition that $\theta_i = \lambda_i - \frac{a}{b}$ implies that the utility for each λ is defined as: $U(\lambda) = \log(b\lambda) + \frac{a}{b\lambda}$, and the wage is defined as: $w_i = b\lambda_i$ This in turn implies that the choice of θ is increasing in λ (strictly if $\alpha > 0$ strictly). Therefore, the environment is characterized by a redistribution favoring the lowest human capital workers, at the expenses of the workers characterized by the highest level of human capital. This determines that each worker prefers to be the one characterized by the lowest level of human capital, in order to capture the benefits from redistribution. ■

The miopic median worker, who does not account for the repetition of the median voter game, prefers to get rid of the lowest quality workers, to capture the instantaneous benefits of redistribution. Therefore, the median worker solves the following problem:

$$\max_{a,b} \log(b\lambda) + \frac{a}{b\lambda} \tag{38}$$

such that:

$$\int_2^3 (b\lambda) \leq \int_3^2 \left(\lambda - \frac{a}{b}\right) d\lambda \tag{39}$$

$$\log(b\lambda) + \frac{a}{b\lambda} \geq 0, \forall\lambda \tag{40}$$

$$a, b \geq 0 \tag{41}$$

Proposition 16 *The contract signed by the median worker specifies that workers endowed with an higher λ than his own can work, while workers with a lower human capital endowment do not, raises the utility of the median voter with respect to the benchmark case of a benevolent union, and finally increases, with respect to the benchmark, the average utility of the workers who actually work; on the other hand, it lowers the average utility of all potential workers.*

Proof. The maximization problem can be rewritten as:

$$\max_{a,b} \log(2b) + \frac{a}{2b} \tag{42}$$

such that:

$$\frac{5}{2}b + \frac{a}{b} - \frac{5}{2} \leq 0 \tag{43}$$

$$\log(2b) + \frac{a}{2b} \geq 0 \tag{44}$$

$$a, b \geq 0 \tag{45}$$

where the median worker is identified as the one with $\lambda = 2$, and where the participation constraint in case of null outside option follows from the fact that $\frac{\partial\left\{\log(b\lambda)+\frac{a}{b\lambda}\right\}}{\partial\lambda} \geq 0$, for $\lambda \geq \frac{a}{b}$, and the resource constraint is referred only to workers participating in the union, and thus participating in the labor market.

The solution is $b = \frac{4}{5}$, and $a = \frac{2}{5}$.

The optimal solution gives the median worker an utility of 0.72, compared to the utility of 0.689 47 that this same worker attains with a benevolent union and in the presence of an analogous outside option. The average welfare is indeed given by:

$$\int_2^3 \left(\log(\lambda b) + \frac{a}{2b}\right)\frac{1}{2}d\lambda = \int_2^3 \left(\log\left(\frac{4}{5}\lambda\right) + \frac{1}{4}\right)\frac{1}{2}d\lambda = 0.468\,20$$

The average welfare here drops with respect to the benchmark of a benevolent union, when it was set to 0.652 46; on the other hand, the average utility for the workers who actually work in this scenario, 0.936 4, is higher than in the benchmark, when it was set to 0.4067. The introduction of the new instrument of workers' selection in the contract induces an increase in the average utility for the selected worker, the effect of which is offset, at the level of average utility, by the effect of excluding a number of workers. ■

The assumption of workers' selection in the contract is not necessarily reasonable, since it implies that workers in the union know the level of human capital held by other workers. In the following alternative scenario, the contract does not specify the workers that are admitted in the union; instead, it specifies a wage for each level of chosen productivity, and all workers whose optimal utility given the menu exceeds zero decide to work.

Proposition 17 *The contract signed by the median worker, when unvoluntary unemployment is not admitted, is analogous to the one in the perfect competition benchmark. It gives the median worker a lower utility with respect to the situation in which human capital endowment is observable. In the aftermath of the contract signed by the union, all the workers decide to work.*

Proof. The median worker maximizes his own utility subject to the constraint that the trade-off from its

$$\max_{a,b} \log(2b) + \frac{a}{2b} \tag{46}$$

$$\int_2^3 (b\lambda)\frac{1}{1+\left(2-\frac{2b-a}{b\log(2b)}\right)}d\lambda + \int_{\frac{2b-a}{b\log(2b)}}^2 (2b)\frac{2-\frac{2b-a}{b\log(2b)}}{1+\left(2-\frac{2b-a}{b\log(2b)}\right)}d\lambda \leq \tag{47}$$

$$\int_{\frac{2b-a}{b\log(2b)}}^2 \left(2-\frac{a}{b}\right)\frac{2-\frac{2b-a}{b\log(2b)}}{1+\left(2-\frac{2b-a}{b\log(2b)}\right)}d\lambda \tag{48}$$

$$\int_2^3 \left(\lambda-\frac{a}{b}\right)\frac{1}{1+\left(2-\frac{2b-a}{b\log(2b)}\right)}d\lambda \tag{49}$$

$$a, b \geq 0 \tag{50}$$

The resource constraint **??** can be rewritten as:

$$
\frac{(a-2b)+2}{\frac{1}{b(\ln b+\ln 2)}(a-2b)+3} \leq \frac{\frac{5}{2}\frac{b}{3-\frac{1}{b(\ln b+\ln 2)}(2b-a)}+4b\frac{\frac{1}{b(\ln b+\ln 2)}(a-2b)+2}{\frac{1}{b(\ln b+\ln 2)}(a-2b)+3}-\frac{2}{\ln b+\ln 2}(2b-a)\frac{1}{b(\ln b+\ln 2)}*}{\frac{5}{2\left(3-\frac{1}{b(\ln b+\ln 2)}(2b-a)\right)}-\frac{a}{b\left(3-\frac{1}{b(\ln b+\ln 2)}(2b-a)\right)}}
$$

$$
+\frac{2}{b}(2b-a)\frac{\frac{1}{b(\ln b+\ln 2)}(a-2b)+2}{\frac{1}{b(\ln b+\ln 2)}(a-2b)+3}-\frac{1}{b^2(\ln b+\ln 2)}\left(a^2-4ab+4b^2\right)*
$$

$$
\frac{\frac{1}{b(\ln b+\ln 2)}(a-2b)+2}{\frac{1}{b(\ln b+\ln 2)}(a-2b)+3}
$$

As the optimal solution to the optimization problem under the set of constraints is too hard to find, we proceed in a different way, and try to obtain some qualitative results.

The median voter utility under the benevolent union, 0.689 47, is exceeded by the utility under the perfectly competitive benchmark 0.693 15. The perfectly competitive scenario may result from the median voter's decision, by setting a very close to 0, and b very close to 1. Furthermore, by setting a very close to 0, and b very close to 1 requiring also the satisfaction of the budget constraint, the median worker is worse off. Therefore, he will set the perfect competition parameters.

Summary 18 *In the impossibility of unvoluntary unemployment, the median worker sets a wage menu as a result of which all potential workers decide to participate in the labor force. It is irrelevant whether or not the median worker cares about the future. The contract specified by the union prescribes the same wages obtaqined under the benchmark of perfect competition.*

■

6 Flexibility

As previously mentioned, the impact of trade unions on the flexibility of the labor market is significant. The literature emphasizes the premium for seniority that the unionized labor markets tend to display, and the consequent rise of the unemployment rate. In my view, privileges for older workers are more hardly sustainable, in the long term, than redistribution towards less skilled labor. As a result, they are usually in place in countries or sector in which either the law or the institutional system regulating labor relations does not offer a sufficiently wide range of valid alternatives to the regulated wage setting.

In order to capture the evolution of wages, it is necessary to introduce some dynamics in the framework.

Consider a very simple variation of the basic model, in which at the end of every time period a percentage of worker ψ retires, replaced by an equal percentage ψ who joins the labor market.

Suppose now that the union cares only about the senior generation, and it maximizes the welfare of the old members. Then the young generation is "exploited", and rents extracted to the young are directed to the elderly, and benevolently redistributed in order to maximize their average welfare.

Now, the union as usual maximizes:

$$\max_{\theta} U\left(w^O, e^O(\theta,\lambda)\right) = \log\left(a^O + b^O\theta\right) - \frac{\theta}{\lambda} + 1 \tag{51}$$

under the resource constraint described by:

$$(1-\psi)\int_1^3 \left(a^O + b^O\theta_i(\lambda)\right)\frac{1}{2}d\lambda + \psi\int_1^3 \left(a^Y + b^Y\theta_i(\lambda)\right)\frac{1}{2}d\lambda \leq \int_1^3 \theta_i(\lambda)\frac{1}{2}d\lambda$$

Given that the individual optimization problem remains unchanged, the usual relation between skill and ability has to hold:

$$\theta_i = \lambda_i - \frac{a^i}{b^i}$$

for $i = O, Y$

I now analyze the effects of seniority premium on the employment rate and on productive efficiency in the case of null outside option for the workers, or, in other terms, in the case in which workers'only outside option is to choose not to work.

Proposition 19 *In the case of two generations of workers, a benevolent union caring only about older workers and able to fix different wages for different seniority, and a null outside option for all the workers, the union chooses wages so that not all the young workers decide to work. In other words, the union is responsible for unemployment.*

Proof. The union maximizing the welfare of its older members is equivalent to the union maximizing the extraction of surplus from the young generation. Indeed, the most the union extracts from the young generation, the most it can redistribute among its older members, the one it really cares about.

Therefore, the problem of the union can be decomposed into two parts. At first, it has to extract the highest possible amount of ressources to the young generations. Secondly, it has to redistribute these resources among members of the old generation.

For the sake of the proof, it is sufficient to examine the first step.

The extraction of the maximal amount of resources at the expenses of the young generation may be expressed as the maximization of the difference between productivity and wage for the members of the young generation.

The objective of the union is therefore to maximize:

$$\int_1^3 \left(\theta_i^Y - w_i^Y\right) d\lambda = \int_1^3 \left(\lambda - \frac{a^Y}{b^Y} - b^Y \lambda\right) d\lambda \tag{52}$$

Each young worker will enter the labor market if and only if:

$$\log b^Y \lambda + \frac{a^Y}{b^Y \lambda} \geq 0$$

derived from the individual utility function coupled with the assumption of null outside option.

The values of a^Y and of b^Y that maximize the older workers' objective, meanwhile determining the full employment of the young generation, is given by:

$b^Y = 0.499$, $a^Y = 0.346881.9980 * 10^{-3}$. These values of the parameters determine an optimal value of the objective function of 0.61370.

Consider now a pair of alternative values for the parameters, such as $b^{Y'} = \frac{1}{2}$, and $a^{Y\prime} = 0$.

$$\log b^Y \lambda + \frac{a^Y}{b^Y \lambda} \geq 0 \Leftrightarrow \lambda \geq 2$$

Hence, only workers endowed with a skill that exceeds 2 find it convenient to work. The new objective function, expressed as:

$$\int_2^3 \left(\theta_i^Y - w_i^Y\right) d\lambda = \int_2^3 \left(\lambda - \frac{a^Y}{b^Y} - b^Y \lambda\right) d\lambda$$

yields a value of 1.25.

This is sufficient to prove the proposition. ■

As a straightforward consequence, the average welfare of the older generation, the senior union members is enhanced, by a percentage of $\frac{\psi}{2(1-\psi)} R$, where R is the rent that union members manage to extract from the young generation. It is also likely, even though it is not proved, that the extra rent will increase wage compression. It is an interesting future extension to verify if the results about flexibility hold in different environment, with alternative outside options for workers.

Corollary 20 *Average welfare of all potential workers in this context is lower than without intergenerational redistribution*

Proof. Simply notice that this wage scheme is different from the one that has been proved to maximize average welfare. ■

The economic rationale behind the assumption of the union maximizing the average welfare of the old workers lies in the attitude of the unions to protect their members. As largely stressed in the instituional literature, insiders' instances may be overevaluated; furthermore, seniority increments the likelihood of taking part in the decision process. Hence, unions tend to assign a higher weight to older members. Differently than in the intragenerational redistribution, there is no economic rationale behind this kind of intergenerational redistribution.

Summary 21 *Unions, when they can, perform intergenerational redistribution to the advantage of senior workers. In the case of null outside option, corresponding to highly regulated and unionized labor markets, this effect is particularly evident. It results in greater well being for the senior workers, lower average well being, and lower productive efficiency. Furthermore, such activity generates unemployment, as the wage menu scheduled by the unions for young workers offers them very low salaries, and in some cases incentivates them not to work.*

7 Comments

Given the stylized nature of the model, it is crucial to understand what are the driving forces of the results. In this paragraph, I am investigating the effects of the outside option, of the relative weight of the wage component of the utility function with respect to the effort portion, and of the curvature of the utility function, on the degree of redistribution that unions manage to achieve, and, as consequences, on the social welfare and on the productivity choices by workers. The analysis of each of the effects will be performed *ceteris paribus*, in order to highlight its own impact.

The role of the outside option has already been mentioned. To summarize its impact, the lowest the outside option, the least unions are constrained in their attempt of redistributing across types; as a result, the highest the outside option is, the highest the total welfare is, the most significant the distortions on productivity choices are, the lowest the average productivity is.

In the model, result are derived under basically three assumptions about the outside otpion. If we are willing to assume no heterogeneity in the outside option among workers, we are implicitly assuming that the only relevant feature affecting it is the institutional environment. This implies that the only relevant feature affecting it is the institutional environment, while all workers have the same bargaining human capital. An institutional environment tending to favor the unions system can build up mechanisms to lower workers' outside option, thus making less strict the unions' constraint, and thereby helping unions to achieve a higher level of redistribution, and (obviously, as always, in case of benevolent unions) a higher average social welfare. Also in the case of homogenous outisde option among workers, however, the value of the outside option could be endogenized (in an environment in which the alternative is the frictionless neoclassical competitive environment) in the first step of the transition to a general equilibrium model.

As previously mentioned, in my setup, firms are offered an ε profit in the unionized system, while they have a null profit, as the economic theory predicts, in the non-unionized frictionless competitive benchmark. In a game theoretic framework, firms are facing a dynamic game. In each period game, they have to choose whether to offer an ε more than their contract under unions to the most productive worker, thus making positive profits for that period, but causing the system to break down, and thus making null profits in all the subsequent periods. The outcome of the decision of whether or not firms prefer to deviate from the unionized wage menu depends on the ε, which in its turn is inversely proportional to the number of firms in the market, and on the firms' discount factor δ, and ultimately on the outside option itself, denoted by *out*. To compute *out* as a function of the parameters, it is first necessary to determine which workers each firm finds it optimal to employ if it decides to deviate form the neoclassical benchmark. They are those who receive a lower wage than their marginal productivity, and they are given by the following expression:

$$a + b \leq \theta_i \Leftrightarrow \theta_i \geq \frac{a}{b\,(1-b)} \Leftrightarrow \lambda \geq \frac{a}{b\,(1-b)} \tag{53}$$

Firms offer those workers a slightly higher wage than unions', and workers for sure gladly accept, because of both the wage growth of for that period, and the growth for all the subsequent periods, in which they will benefit from the breakdown of the system, receiving their benchmark wage[4]. Firms' one period earning in that context is therefore represented by:

$$\int_{\frac{a}{b(1-b)}}^{3} \left(\theta - a^{out} - b^{out}\theta\right) f\,(\lambda)\, d\lambda$$

Firms decide optimally not to deviate if and only if :

$$\int_{\frac{a}{b(1-b)}}^{3} \left(\theta - a^{out} - b^{out}\theta\right) f\,(\lambda)\, d\lambda \leq \left(\frac{\varepsilon}{1-\delta}\right) \tag{54}$$

A way to endogenize *out* consists in deriving it from the previous expression, knowing that the left hand side grows with *out*. In other words, it is possible first to evaluate the right hand side, then to determine the optimal pair of (out, e) such that 54 holds, and finally to solve for the optimal values of a and b given *out*. Adopting this framework to determine *out*, we can conclude that a higher discount rate lowers *out*, making future payoffs from not deviating more attractive. This in turn raises social welfare, and lowers productive efficiency. Exactly the same argument can be applied to ε, the one-period profit offered to firms in the unionized system.

In two other illustrated scenarios, the outside option has been regarded as heterogeneous, and resulting from the endowment for each worker of a level of specific human capital γ describing his bargaining ability. γ has been considered

[4] It is true that if workers discount the future enough, the most productive are willing to pay a one-period fee, in terms of diminished salary, in exchange for an increase of their compensation in all subsequent periods. Thus, I make here the conservative assumption that workers do not discount the future.

both correlated with the on-the-job human capital λ (in this case, γ cannot properly be defined as specific human capital), and totally uncorrelated with λ (in this case being properly specific).

The main emerging results, keeping into account the fact that the union maximizes the welfare of all the workers, including those who optimally decide to choose their outside option, are the following:

1. The lowest the workers'outside option is, the least the benevolent union is constrained in its redistributive purposes, the highest is the gain achieved by the union in terms of social welfare.

2. If the benchmark is a competitive frictionless neoclassical framework, social welfare achieved through redistribution and productive efficiency are negatively correlated.

3. If heterogeneity among workers in their specific bargaining human capital is introduced, then employees' outside option is lower than their marginal productivity with probability 1, and the union in this instance can both increase social welfare and productive efficiency. However, it is not clear how this can fit in a general equilibrium framework.

4. If the workers' outside option is homogenous, the benevolent union keeps the totality of worker within it.

5. If the workers' outside option is heterogenous, resulting from a specific bargaining human capital, correlated or uncorrelated with the on-the-job human capital, the benevolent union does not keep all the workers within it.

Until now, this section has just examined a driving force of the results encompassed in the constraints of the optimization problem solved by unions, the workers' outside option. The following two illustrative factors, on the contrary, are included in the utility function. The first is represented by the relative weight of the utility from wage with respect to the disutility from effort, assuming separability between the two. The highest is the value of wage to the employees, the least unions are constrained by the resource constraint, since workers will tend to choose anyway an occupation close to their benchmark, as long as $b > 0$. At the limit, if the weight of the wage is overwhelming with respect to the weight of the effort, and if the *out* is small enough, an infinitesimally small variable portion of the wage will be sufficient to keep workers stuck on their benchmark non-union occupation choice. In this case, as long as utility from wage is increasing, unions achieve a perfect equalization of wages. The scenario would be ideal, since unions in this case would increase social welfare, still being very close to the productive efficiency. With a high *out*, productivity choices would still be around their benchmark, but the social efficiency would be lowered.

Finally, the curvature of the utility function plays a major role. If the marginal utility of wage decreases very rapidly, high productivity workers lose less by receiving a lower compensation with respect to the non unionized benchmark. Also, they do not choose a very different occupation with respect to the productive efficiency situation. With respect to the scenario determined by a utility function characterized by less curvature, unions at the optimum generate a greater amount of redistribution, and are closer to productive efficiency.

8 Conclusions

The paper illustrates a stylized framework that accounts for the activities of wage compression and of seniority premia usually attributed to the trade unions. It investigates which governance systems and which ultimate objectives may be coherent with the pursue of such activites. Given some suitable governance systems, it then evaluates the impact of the unions on unmeployment and on productive efficiency under a number of hypotheses relative to the workers' outside option.

The results show that a benevolent union, as a tendency, is willing to compress wages, because of the decreasing marginal utility of wealth. This redistributive activity, however, coexists with a different activity of reparations of market failures, which are triggered by the bargaining inability on the part of the workers and by the incomplete information framework, and which may operate in an opposite direction. It turns out that the outside option available to the workers is crucial to determine whether a benevolent union really redistributes wealth from the most to the least endowed workers. The alternative hypothesis of median worker ruling the union does not shed light on the wage compression activity performed by the unions. Indeed, the median worker selects an analogous contract to the one observed in the case of frictionless perfect competition.

A benevolent union is also willing to value seniority, thus entailing a greater rigidity on the labor market.

Finally, the redistributive activity towards less productive individuals, in the form of wage compression, bears the price of a drop in productive efficiency; the redistribution towards senior workers, on the other hand, fosters a higher level of unemployment.

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