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Employer's moral hazard and wage rigidity

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Employer moral hazard and wage rigidity

The case of worker-owned and investor-owned firms

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Abstract

The standard explanation of wage rigidity in principal agent and in efficiency wage models is related to worker risk-aversion. However, these explanations do not consider at least two important classes of empirical evidence: (1) In worker cooperatives workers appear to behave in a less risk averse way than in for profit firms and to accept fluctuating wages; (2) The emerging experimental evidence on the employment contract shows that most workers prefer higher but more uncertain wages to lower fixed wages. Workers do not appear to express a preference for fixed wages in all situations and different ownership forms, in our case worker cooperatives and for-profit firms, behave in different ways when dealing with the trade-off between wage rigidity and employment fluctuations. More specifically, worker cooperatives are characterized, in relative terms, by fixed employment levels and fluctuating wages, while for-profit firms are characterized by fixed wages and fluctuating employment.

Our paper reinterprets these stylized facts by focusing on the relationship between wage rigidity and worker risk aversion in light of the presence of employer post contractual opportunism. Contractual incompleteness and private information on the side of the employer can compound in favouring the pursuit of the employer's objectives, when they diverge from the employee's ones. The idea of employer moral hazard is able to disentangle the observed behavioural differences in different ownership forms. By resorting to the standard efficiency wage framework, we show that, in the presence of employer moral hazard, employees in capitalistic firms generally prefer fixed wage, accepting this way a positive risk of lay-off. On the contrary, one of the main functions of fluctuating wages in worker cooperatives is to minimize the risk of lay-off.

Key words: risk aversion; employer contract; moral hazard; asymmetric information; hidden action; risk aversion; income insurance; employment insurance; worker cooperatives

Employer moral hazard and wage rigidity

The case of worker-owned and investor-owned firms[♣]

Different ownership forms, in our case worker cooperatives and investor owned, for profit firms, behave in differently when dealing with the trade-off between wage rigidity and employment fluctuations. More specifically, the evidence shows that worker cooperatives are characterized, in relative terms, by fixed employment levels and fluctuating wages, while for profit firms are characterized by fixed wages and fluctuating employment levels (Craig and Pencavel, 1992; 1994; Bonin, Jones and Putterman, 1993; Bartlett, Cable, Estrin, Jones & Smith, 1992; Pencavel, Pistaferri and Schivardi, 2006; Burdin and Dean, 2009; Alves at al., 2012).

One important implication of this evidence is that workers do not appear to express a preference for fixed wages in all situations. At least in some cases, such as in worker cooperatives, and in experimental settings, workers appear to prefer fluctuating wages. This runs counter some of the main assumptions of most theoretical models dealing with the employment contract (most prominently the principal-agent models and the efficiency wage models) which take risk aversion as the psychological characteristic of workers that most crucially explains wage rigidity. The cited evidence is instead compatible with recent experimental results which show that in the absence of employers' private information about the results of the business activity, workers show a lower degree of risk aversion and are willing to accept fluctuating wages, as most of them prefer higher but fluctuating wages to lower but fixed ones (Bartling, Fehr, and Schmidt, 2011; Domhen and Falk, 2011).

Our paper is set to work out a convincing explanation of these stylised facts by reinterpreting the relationship between wage rigidity and worker risk aversion for incomplete contracts in light of the risk of employer post contractual opportunism connected with the presence of private information and diverging objectives relative to the employee. In our view, the idea of employer moral hazard can explain the observed behavioural differences between different ownership forms and offer new insights on existing and perspective experimental evidence. To support our claims,

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we develop an efficiency wage model in which employers hold private information about exogenous demand shocks and can use this private information to reduce the wage. We show that, when the risk of employer's post contractual opportunism implies a relevant expected cost to the employee, the latter will generally prefer fixed to fluctuating wages, even if this preference entails a higher risk of unemployment. The exception to this rule is found when unemployment and the cost of search of a new job grow large. In this case, the expected costs of unemployment can become unbearable and may advice the employee to accept a more volatile remuneration. Conversely, in the absence of the risk of employer moral hazard, which is assumed to be the standard matter of course in worker cooperatives, in the general case workers prefer fluctuating to fixed wages, because this choice allows to eschew search costs.

Our arguments contribute to the literature by giving a plausible explanation of extant empirical evidence. It highlights the mechanisms that make cooperatives better able to stabilize employment levels and reduce to the minimum the risk of involuntary lay-off. They also contribute to explain why cooperatives show anti-cyclical behaviour (hire less in periods of economic growth and shed less jobs during economic crisis) and appear more resilient to economic crisis than capitalistic firms. On the other hand, our arguments are not sufficient to explain the low incidence of worker cooperatives and, more generally, of democratically managed firms in market economies. Other studies concerning financial mechanisms supporting cooperative growth, such as self-finance and credit rationing, the costs and effectiveness of cooperative governance, X-efficiency of the cooperative endeavour are necessary in this direction (Furubotn and Pejovich, 1970; Vanek; 1970; Bonin, Jones and Putterman, 1993; Hansmann, 1996; Bowles and Gintis, 1994; Dow, 2003).

In Section 1 we critically review the literature on wage rigidity in capitalistic firms. In Section 2 we spell out the hypothesis of employer moral hazard under asymmetric information as main determinant of wage rigidity. In Section 3 we introduce the efficiency model explaining wage rigidity in for-profit firms. In Section 4 we establish the conditions under which workers prefer fixed to flexible wages in capitalistic firms. In Section 5 we compare worker choices concerning wage rigidity in capitalistic firms and worker cooperatives. Section 6 concludes.

1. Wage rigidity in capital managed firms

A usual argument explaining why in capitalist systems wages tend to be fixed while firms adjust the size of the employed workforce, is workers' risk aversion. This assumption is crucial in the seminal contribution by Frank Knight (1921), who stated that the firm is an agreement between workers and a risk-neutral entrepreneur, to whom risk-averse workers hand over control on the

activity in exchange for a risk-free remuneration. This implies that risk-averse workers prefer stable to fluctuating wages. In their review of contract theory and labour market models, Mori and Tedeschi (1994) clearly state that the solution of worker's utility maximization problem implies rigid remuneration and is crucially dependent on the assumption of risk-averse worker facing a risk neutral firm.

In the same line, we find the implicit contract literature (Baily 1974, Azariadis 1975, Azariadis and Stiglitz 1983), which starts by observing that wages fluctuate much less than marginal productivity of labour and that, more specifically, business cycles are more likely to produce changes in employment rather than fluctuations in wages. The interpretation these authors give to the phenomenon of wage rigidity is that labour contracts involve an insurance component between a risk-neutral firm and a risk-averse worker. This implicit insurance contract makes it possible to have wages that are more stable than the marginal productivity of labour. In exchange for this insurance, workers let the employer control the organization and appropriate its residual revenue. The firm is understood as being composed by 3 departments (Azariadis and Stiglitz 1983): the production department, to which the workers provide their services; the accounting department, which pays wages; and the insurance department providing insurance to workers. Where the marginal productivity (P') is low, insurance is positive and makes wages exceed P', while, when the P' is high, insurance is negative and the firm pays a wage lower than P'. Baily (1974), in fact, proves that it's profitable to the firm to adopt an asymmetric strategy toward wages and employment, that is to pay a preannounced non-stochastic wages, but to be free to change the size of the employed workforce. Consequently, we highlight the fact that implicit contract literature has explained wage rigidity as wage insurance at the cost of forfeiting a convincing explanation of employment insurance.

The starting point of our arguments is a critique to this approach. We maintain that the theoretical connection between workers' risk aversion and wage rigidity is basically flawed because of different reasons:

1) it assume risk aversion as a psychological characteristic of workers. This leads to the overlooking of some important parts of the empirical evidence;

2) it explains the employment contract as an insurance contract without considering in a suitable way the problem of employment fluctuations;

3) it is hardly reconcilable with other important streams in the literature. For example, and most prominently, in the new institutionalist tradition initiated by Ronald Coase in 1937 the employment contract is characterised in terms of hierarchy and not in

term of insurance. Later writers in this tradition, for example the property right school (Grossman and Hart, 1986; Hart and Moore, 1990) stressed the importance of contract incompleteness, asymmetric distribution of power and asymmetric information more than the insurance functions of contracts.

In our approach no specific assumption concerning workers' risk aversion as a pre-contractual psychological feature is made. However, we stress that different institutional settings are likely to make workers face different risks and contractual costs, therefore inducing them to undertake different choices. This is clear in the new institutionalist approach put forward, for example, by Hansmann (1996). In his model, contractual relations in different ownership forms are characterized by different types and amounts of transaction costs. The existence of ex-ante market power in terms of monopoly and monopsony power, ex-post market power in terms of lock-in and opportunism, and asymmetric information can greatly impact on the decision set faced by workers. In this perspective, ex-post contractual power and asymmetric information are crucial in explaining why workers may prefer fixed to fluctuating wages in exchange for a higher or lower risk of lay-off.

Reinterpreting the same problem in a different way we can state that, while it is clear that the smoothing of labour income can have an insurance function, it is not convincing to conclude that workers always prefer to smooth wages and to face the risk of unemployment, as the empirical evidence clarify that employment stability is one of the main workers' objectives (Depedri, Carpita, and Tortia, 2012). Hence, workers can be hypothesized to be willing to trade-off some degree of wage stability with enhanced employment protection. Besides, and connectedly, even when an empirically informed hypothesis concerning workers' risk aversion can be substantiated, this does not imply an absolute preference for wage rigidity since risk aversion can be extended to include the risk of unemployment.

Further empirical evidence running counter risk aversion as the sole rationale explaining wage rigidity and employment fluctuations come from the theoretical and empirical analysis of worker cooperatives. Many empirical tests demonstrate that, in worker cooperatives, wages (or, more generally, labour income) show significantly stronger variability while, at the same time, employment levels are more stable than in profit maximizing firms (Craig and Pencavel, 1992, 1994; Pencavel et al., 2006; Burdin and Dean, 2009). This implies that the actual realization of the degree of wage related risk aversion cannot be assumed as an overarching pre-contractual psychological feature of workers since it is context dependent. Consequently, while it has been noted that worker cooperatives accomplish a notable inversion of the employer to employee relation

vis à vis capitalistic firms (Jossa and Cuomo, 1997), we highlight that this inversion implies also a modification of the wage-to-employment relation: employment becomes rigid in the short run, while labour income tends to fluctuate. Indeed, as early as in 1983 some authors (Myazaki and Neary, 1983) evidenced that "job insurance" instead of "wage insurance" is likely to be the dominant objective in worker cooperative. This conclusion, however, does not fully clarify what are the specific features of cooperatives that allow workers to overlook wage variability as a potential source of losses and allow them to concentrate on guaranteeing long term stability in employment levels. Following the conclusions reached by other authors (Meade, 1972, Dow, 2003, Miceli and Minkler, 1995), we hypothesise that worker cooperatives are able to modify the structure of risk faced by workers, shifting risk from employment fluctuations to wage fluctuations. When reference is made to the emerging and growing experimental evidence concerning employer-employee interaction and wage setting, we see that, other conditions being equal, most workers prefer higher and fluctuating wages to lower but fixed ones (Domhen and Falk, 2011). This evidence, in a still more powerful way, militates against an explanation of wage rigidity that is based on the risk aversion assumptions alone.

We hypothesise, instead, that the preferences expressed by workers are crucially affected by the institutional context in which workers operate. In capitalist enterprises workers do not have control rights, and may not have access to important information concerning the firm economic conditions and prospects. Consequently, workers can be expected to express a stronger preference for wage rigidity to counterbalance the risk of employer post contractual opportunism, which can take the form of hidden action and abuse of authority, in the presence of contract incompleteness and asymmetric information. In worker cooperatives, instead, worker members undertake entrepreneurial action in a collective way and govern the organization on equal and democratic grounds, following the "one member, one vote" rule.[1] Since workers enjoy control rights, they do not undergo the risk of morally hazardous behaviours by the employer and can accept more volatile wages in order to secure employment stability.[2]

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[1] We clearly acknowledge that also worker cooperatives are liable to various instances of opportunistic behaviours both within the group of principals that constitute their membership, and between these principals and other categories of patrons such as managers. Clear examples of opportunistic behaviours in cooperatives are represented by free-riding in teamwork (Alchian and Demsetz, 1972) and by managerial decisions that are not aligned with the objectives of the membership. We will not deal with these instances in this contribution since this is exclusively focussed on the trade-off between wage rigidity and employment stability.

[2] We do not deal with the agency relation between worker members and managers in cooperatives as compared to the agency relation between investor owners and managers in for profit companies. Given the large literature that has been

2. Labour contract under information asymmetries and employer moral hazard

A vast literature integrates private information into labour contracts as one of the elements that makes these contracts incomplete. This concerns both information asymmetries *stricto sensu* and hidden/unobservable action or abuse of authority (Sacconi, 1992). In principle, it may apply to both sides of the employment relationship. Indeed, the literature on agency relations has widely acknowledged the possibility that the misalignment between employers' and employees' objectives increases the probability of morally hazardous behaviours (such as shirking and misreporting of information) by the employee when contracts are incomplete.

On the side of the employee's opportunism, the literature on agency relations sought to establish the features of contracts able to elicit the optimal level of worker effort in the presence of unobservability of their actions. Pay-for-performance contracts are understood as tools able to reach this aim, but are dependent on output measurability (Prendergast, 1999). Connectedly, Lazear and Shaw (2007) show that wages in most occupations are now much more variable than in the past in the US economy. The two authors explain this evidence by stating that wages can become variable when the output is observable as it happens, for example, in the case of salespersons, dealers and traders in investment banks. In cases in which the output is partly or completely unobservable either by the employer or by the employee, fixed wages tend to prevail (Navarra and Tortia, 2011). None of these research streams explicitly consider the problems connected with the presence of private information on the employer side. Consequently, scant attention has been paid to the employer interest to lower labour costs by misrepresenting work quality and increasing work pace, and to strive to have employees bear the costs of wrong entrepreneurial choices (*inter alia* Alchian and

highlighting the biasing effects of this agency relation in the for profit companies (starting from Berle and Means, 1933), we do not exclude that the agency relation in cooperatives can have biasing effects as well. However, we reckon the agency relation in worker cooperatives as substantially different from the agency relation in for-profit firms. In the former case, managers are appointed by directors that are elected by worker members and respond to workers' objectives. In for profit firms, instead, managers pursue the objectives set by investors which mainly rest with the maximization of shareholder value. Control mechanisms and agency costs are to be examined differently in the two cases since managers in cooperatives are expected to undergo stricter direct control by the members of the organization, while they undergo looser indirect control by financial markets in terms of risk of hostile take-overs. On the contrary, share prices and takeovers are taken to be the most relevant control mechanisms in investor owned companies. Bowles and Gintis (1994) affirm that the arbitrary use of power by management against workers is likely to be reduced, as the manager is subject to dismissal by the workers rather than by investors.

Demsetz, 1972, Stiglitz, 1975, Holmstrom, 2000, Screpanti, 2001. Among the few critical remarks on this theme cfr. Dow, 1987).

Indeed, some empirical works came close to hypothesize a direct connection between opportunistic behaviours by the firm and wage rigidity, but eventually they failed to do so[3]. Basing his results on managerial survey data, Kaufman (1984) states that employers avoid wage cuts because of concerns about productivity, since workers view wages as a "reward for performing competently" and would regard wage cuts as an "affront". Using the same methodology, Blinder and Choi (1990) state that wage cuts mat easily affect work effort, quits and the quality of future applicants because unfair wage policies are considered unacceptable, but "…that does not necessarily rule out wage reductions under the right circumstances". Moreover, "Generally, wage reductions made to save the firm from failure or to align wages with those of competitors are view as justifiable and fair, while those made just to raise profits are not" (Blinder and Choi, 1990, 1008-1009). These statements endorse the view that workers can be willing to accept wage cuts under specific circumstances and are compatible with our approach insofar as they evidence the importance of morale and labour turnover costs (Blinder and Choi, 1990). Also, like in our approach, no relevant connection is found between workers' risk aversion and wage rigidity. However, they come short of explaining wage rigidity since: (i) they do not explain why wage cuts are so rare in real settings and (ii) they do not to establish a clear hypothesis about a *general* connection between the firm opportunistic behaviours and wage rigidity.

While we deal with the ex-post contractual opportunism of the employer, we do not consider the problems connected with asymmetric information before the employment contract is signed. That is, we do not consider adverse selection both on the side of the employer and of the employee. We work in a context in which the matching between workers and firms is taken as given since it has already taken place. As for ex-post contractual opportunism we distinguish two cases within the framework of incomplete contracts. First we refer to the morally hazardous behaviour of the employer connected with the availability of private information. The employer knows better than the employee the nature of exogenous shocks and can use this private information in a distorted way to induce the employee to accept a lower wage. Second, we consider the case of the employer's hidden action, that is the risk connected with the investment plans implemented by the employer. If the wage is flexible the employer can be induced to implement too risky investment projects because he knows that in case of negative outcome he/she will be able to make the employee bear

[3] For a review of the empirical literature on wage rigidity in economics, behavioural and experimental economics, and in management sciences and organizational psychology the reader can consult Bewley, 2005.

the whole cost or part of it in terms of lower wages. In this case the employer would be insured in his investment choices by the flexibility of wages. In both cases we can expect that the worker anticipates the risk of the employer moral hazard by expressing a preference for fixed over flexible wages. In turn, the employer may agree to pay a fixed wage in order to eschew the risk that the employee requires a too high risk premium on wage volatility. In many cases, while both the employer and the employee would be better off in the presence of flexible wages, a Pareto inferior solution is reached because flexible wages are too risky to the employee and, because of this reason, too costly to the employer.

Some works deal with the problem of the firm's private information (Mori and Tedeschi, 1994), but they deal much less with the employer's hidden action. In labour contracts models, wages and employment are contingent upon the "states of the world", that is to say the level of demand, and therefore prices. In incomplete information models, the level of demand represents the unobservable variable that can be known by the employer, while the worker only knows its distribution. The possibility that the employers hide information about the true state of the world is usually ruled out by the so-called "revelation principle" which, relying on the assumption that workers know the firm's profit function, states that it always exists at least one contractual agreement that workers can propose to the firm which, without making both parties worse off, induces the firm to reveal his private information. We criticize the revelation principle on two different grounds: first of all, the assumption according to which workers know the firm's profit function can be questionable in more realistic settings. For example, in dynamic settings in which price and quantities change overtime together with production and investment plans, the profit function may not be known at least in the medium to long run. Moreover, we argue that that fixed-wages represent the contractual agreement that workers can always use to induce the employer to reveal his/her private information since the fixed wage eliminate any incentive to hide information about the firm economic condition.[4] In other words, the fixed wage represents a worker best response to the looming risk of employer opportunism and, as stated, the mutual choice of fixed wages by employers and employees implies fluctuating employment levels.

When a dynamic perspective is taken, we highlight that the employer is likely to have private information on the probability of future events, such as demand shocks, and on prospective profits, for example by exploiting privileged access to entrepreneurial social networks. Second, the

[4] Indeed, even this conclusion may not be true in dynamic settings since in the presence of collective bargaining the fixed wage can be revised upwards when individual or unionized workers get to know the true profit function of the firm.

employer has private information on his/her own future decisions, which, by themselves, are able to modify expected profitability. The employer future decisions represent, on the side of the employee, exogenous and uncontrollable events. This implies that the decisions taken by the employer can modify the probability of different states occurring in the future. When employees accept fluctuating wages the employer can more easily make employees bear the cost of wrong decisions. For example, the decision to distribute more profits may undermine the financial strength of the firm, and increase the probability of future lay-offs. Or, too risky investment decisions can increase the probability of future losses. The employer may also hide as long as possible strategic choices concerning the closure and/or relocation of the activity. Finally, also ordinary decision making in the management of the organization can imply a non-negligible probability of losses to the employee. Choices concerning new and competing technologies, what managers to hire, or what organisational models to implement represent obvious examples of discretionary choices that influence profitability, but cannot be controlled by the employee. Thus workers are expected to anticipate the risk of the employer moral hazard by expressing a preference for fixed over flexible wages.

3. Wage rigidity in investor owned, for-profit firms

In developing our model we hypothesize a labour market characterized by the presence of asymmetric information. The employers behave as one unique monopolist setting wages at a level high enough to eschew the risk of shirking by the employee (Shapiro and Stiglitz, 1984). In this stream of literature it is possible to single out efficiency wages models and "worker disciplining" models. Our contribution refer to the 1984 model by Shapiro and Stiglitz, who show that involuntary unemployment can be compatible with the equilibrium on the labour market even when the monitoring of the work activity is not perfect. This kind of involuntary unemployment is not due to workers' unwillingness to accept salaries lower than the current ones, but to employers' unwillingness to lower wages down to the market clearing level[5].

The worker utility function is $U(w,e)$, where w is the wage and e is work effort, which is either 0 (in the case of shirking workers) or positive. Standard assumptions on the shape of the utility function apply (con $\partial U/\partial w > 0$ e $\partial U/\partial e < 0$). The probability that the worker is caught shirking

[5] This implies that, when we compare the two options of flexible and fixed wages, we assume the existence of a minimum wage level.

following monitoring activities is *q*. If the worker is found shirking he or she is laid-off and, in this case, he or she would receive a subsidy equal to *b* up until when she does not find a new job. Each unemployed worker is able to find a new job with probability *a*. This probability is equal to *L/N*, where *L* is the number of employed workers, while *N* is the total active workforce (that is $0 \le L \le N; 0 \le a \le 1$). The probability to find a new job for unemployed workers is equal to 1 minus the unemployment rate, $a = 1 - (N-L)/N = L/N$; this probability grows with the employment level and decreases with the unemployment rate. We make the simplifying hypothesis that the utility function of the worker is linear in the wage and effort $U(w,e) = w - e$. The expected utility level for a worker that chooses to shirk is *Uo* (in which case $e = 0$) and it is determined by the wage minus the expected loss of utility if the worker is caught shirking, $q(Uo - Uu)$, where *Uu* is the amount of utility associated with unemployment. Hence:

$$Uo = w - q(Uo - Uu) \text{ , that is } U_0 = \frac{w + qUu}{1+q} \tag{1}$$

If, instead, the worker does not shirk, his/her expected utility is equal to $Ui = w - e$. Hence, the choice not to shirk ($e > 0$) depends on the following condition:

$$Ui \ge Uo, \text{ or } \quad w - e \ge \frac{w + qUu}{1+q}, \text{ that is } \quad w \ge Uu + e + \frac{e}{q} \tag{2}$$

The value $Uu + e + e/q$ represents the minimum level of the wage that the employer has to correspond to the worker to discipline him/her on-the-job. This is the no-shirking constraint *(NSC),* which can also be interpreted as efficiency wage. The employer compares the worker's marginal productivity with the value of the *NSC* in order to decide the amount of work demanded. This way, in equilibrium, employers' obtain the maximum work effort from the workers.

The expected utility of unemployed workers is $Uu = b + a(Ui - Uu)$, which is equal to the sum of the unemployment subsidy *(b)* and the increment of utility derived from the possibility to find a new job (recall that the probability to find a new job is *a)*. Since $Ui = w - e$, we obtain:

$$Uu = \frac{b}{1+a} + a\frac{w-e}{1+a} \tag{3}$$

Which allows a more explicit reformulation of the *NSC* as: $w \ge \frac{b}{1+a} + a\frac{w-e}{1+a} + e + \frac{e}{q}$

And, simplifying:

$$w \ge b + e + (1+a)\frac{e}{q} \tag{4}$$

Recalling the definition of *a* it is possible to obtain the following relation between the employment level and the efficiency wage:

$$w \geq b + e + \frac{e}{q} + \frac{e}{qN} L \tag{5}$$

The non-shirking constraint is found on the right of this inequality.

We observe that an increase in the unemployment subsidy *b* causes an upward shift in the *NSC,* which grows with the level of employment. When either *b* or *a* (that is, given *N,* when employment *L* grows*)* grow, also *Uu* grows. This implies a reduction in the deterrent effect of unemployment, and an increase of the incentive to shirk. Hence the firm is obliged to increase the wage to induce the worker to keep on working hard.

On the contrary, given the unemployment subsidy, when the rate of unemployment grows there is a reduction in the probability to find a job and the efficiency wage necessary to induce workers not to shirk, as found on the *NSC,* decreases. When the work effort required by the firm, *e*, increases, the NSC moves upward and rotates leftward. This way, the efficiency wage increases for each level of employment. The increase in work effort needs to be compensated by a higher efficiency wage in order to induce the worker not to shirk. When the effectiveness of the monitoring activity increases (*q* increases), the *NSC* moves downwards and rotates rightwards. The incentive to shirk is reduced. In the following diagram we represent the equilibrium *with positive unemployment* on the labour market. Labour demand is given by the marginal productivity of labour *df/dL,* while labour supply is constant and given by *N,* independently of the wage level. The equilibrium is found at coordinates *L** and *w**, as in the Shapiro and Stiglitz model.

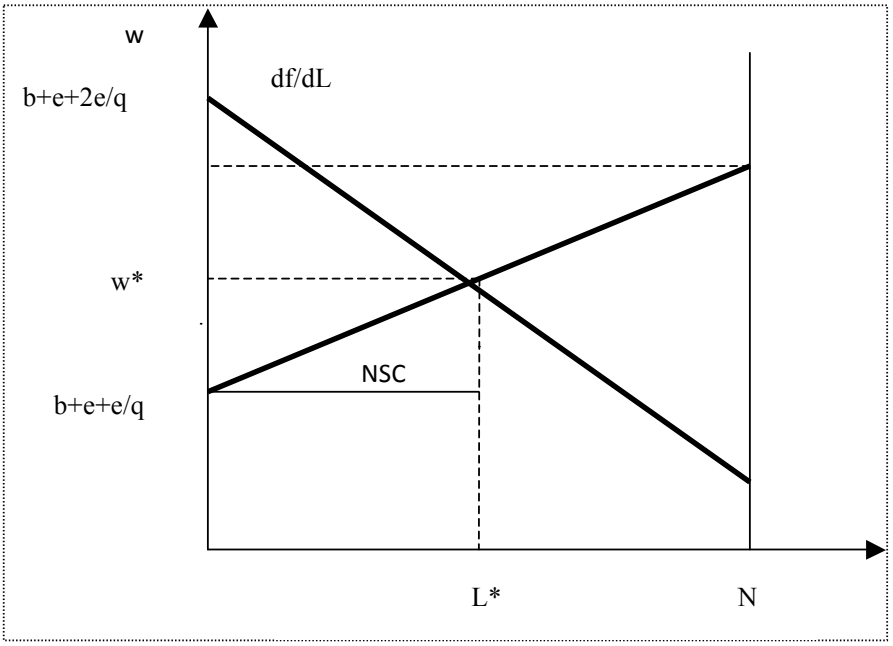

Figure 1. Equlibrium on the labour market with efficiency wages and positive unemployment

4. The choice of the worker under uncertainty

We assume, as in the Shapiro and Stiglitz (1984) model, that there are no specific investments in human capital[6], but there are job switching costs[7]. We hypothesize that, in a labour markets characterized by imperfect information, incomplete contracts and decision making power concentrated in the hand of investors, the risk implied by the employer hidden action and hidden information affects workers' behaviour. More specifically, we posit that the moral hazard of the employer ensues from opportunistic decisions, which are due to the employer objective function (profit maximization). The employer cannot commit not to reduce wages (if flexible wages are in place), since its objective function requires cost minimization. The negative consequences of the employer's choices are borne by workers in terms of lower wages and/or increased work pace.[8] In the case of demand shocks, the principal can reduce wages to a lower than optimal level. In this

[6] We assume the worker has not made specific investments because in that case the cost of switching is higher. In that case he would prefer flexible wage.

[7] Since switching costs are positive, the NSC in Figure 1, as in the Shapiro and Stiglitz (1984), shifts downward in a measure proportional to the value of the job switching cost.

[8] Variations in wages and work pace are equivalent when the wage is calculated as monetary remuneration per unit of product delivered by the worker.

context, wage rigidity can be demanded by employees as optimal response to the risks of the employer's opportunistic behaviours. Wage rigidity becomes a precondition allowing employers and employees to reach contractual agreement.

In a more thorough description of the model, we assume a monopolistic union of competitive firms: the union subscribes a wage at the time t. There's a probability of the realisation of a random shock to product demand. The wage w* is the level of the efficiency wage set in the above described way. There are two possible types of wage contracts:

(1) fixed wage (employment is contingent on the shock);

(2) fixed employment (wage is contingent on the shock).

Ex-ante, the worker has to choose between the two mentioned options since he/she has not information concerning future shocks and can only estimate the cost of finding a new job in relation to the rate of unemployment. In case of negative shocks the level of unemployment changes (increases), lowering the NSC and the equilibrium level of the wage. The effects of negative shocks on employment cannot be unambiguously predicted since the negative impact of the demand shock can be compensated by the lowering of the NSC.

A generic worker makes his choice maximizing his expected utility function in the case of option (1) and (2).

Option 1) Fixed wage without employment stability

At the starting of each period the worker estimates p as the probability of absence of negative shocks and (1-p) as the opposite probability.

If the shock doesn't take place the worker's utility is equal, with probability p, to the wage w*, determined as before, minus the level of effort. If the shock occurs the worker shall bear the cost of finding a new job (ε). More specifically, ε measures the individual cost of searching a new job, the switching cost. This cost, which is related to the cost of unemployment, is not included in the Shapiro and Stiglitz analysis.

The worker's expected utility is[9]:

$$E(U)_A = pU(w^* - e) + (1-p)U(w^* - e - \varepsilon) \qquad (6)$$

[9] The value of unemployment benefit is not included in this function as we assume the wage is higher than the level defined by the non-shirking constraint in 5. We do not introduce the value of *Uu* as defined beforehand, as this quantity includes the value of *b* and because we explicitly estimate the individual cost of job search which is not included in *a*.

The value of ε is: $\varepsilon = du$, where d is the parameter that measures workers' sensitivity to unemployment rate $u = \frac{N - L}{N}$[10]. The cost of job search increases when *u* increases. This implies that, if the rate of unemployment is very high the cost of finding a new job is also high (the value of ε increases: $\delta\varepsilon / \delta u > 0$) as the probability to find a new occupation is low. The value of ε is zero when unemployment is nil.[11] Table 1 shows the relationship between the rate of unemployment and the value of ε.

Table 1. Unemployment and search costs

Value of u	Value of ε
$u = 0$	$\varepsilon = 0$
$0 < u < 1$	$0 < \varepsilon < \varepsilon_{max}$
$u = 1$	$\varepsilon = \varepsilon_{max}$

Option 2) Employment stability and flexible wage

If a negative shock occurs, the labour demand curve shifts downward. In equilibrium, while the employment level is fixed at level L*, income decreases to w' (figure 2). However, the employer can take advantage of his/her private information and further lower the wage.

In this case the employee can incur in the employer's moral hazard as the employer can lower the wage more than the equilibrium condition would grant. More specifically, in the case of demand shocks, the principal can reduce wages to the minimum level of NSC[12] even if a reduction of wage to the level w' could be optimal to absorb the shock.

[10] _The value of d is strictly related to the risk aversion of the worker. If he is neutral to risk its value is lower than in the case of a risk averse individual and the cost of searching a new job is lower too.

[11] The probability to find a new job (*a*), included in the level of efficiency wage, is strictly related to the value of u, since the value of *a* is 1 when the value of *u* is zero.

[12] The level of the wage $w'_n = b+e+e/q$ is the lowest possible wage level compatible with the NSC. It represents the compatibility of incentives constraints. The level of the participation constraint is, as stated, $Uu = \frac{b}{1+a} + a\frac{w-e}{1+a}$.

The value of this cost *(c)* represents the cost of the possibility that, although the wage that makes idleness costly to the worker and ensure shock absorption is equal to w', the employer chooses to lower the wages down the level that meets the constraint NSC, which is w'_n= b+e+e/q.

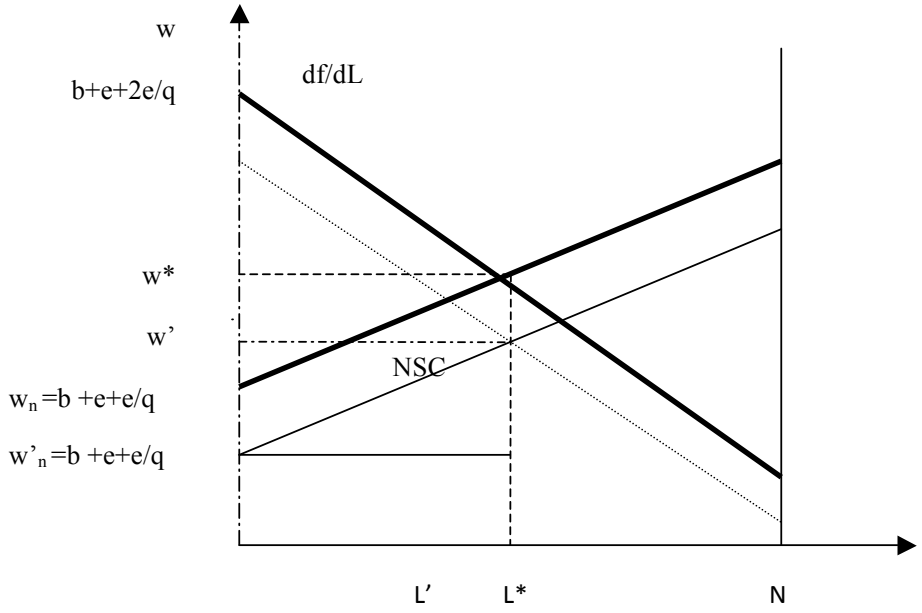

Figure 2. The impact of a negative demand shock on the no-shirking constraint

The worker's expected utility is:

$$E(U)_B = pU(w^* - e) + (1-p)U(w_F - e' - c) \tag{7}$$

where $w_n < w_F < w'$ and $w' < w^*$ (8)

w_F is the wage expected in case of negative shock and *e'* the related level of effort[13]. In this case too, (1-p) is the probability of a negative shock taking place and p is the probability that the shock doesn't take place. The choice of the employee isn't related to the unemployment rate, but to

[13] We assume that the effort level positively depends on the wage level. That is, wage reductions imply effort reductions. We introduce this assumption because, since utility positively depends *only* on the wage level, without this specific assumption wage reductions would imply loss of utility to the worker. If utility depended positively also on other, non-monetary arguments (e.g. on-the job amenities) then effort reduction following wage reductions would not be a necessary result any more.

the cost, which we define *c,* arising from the possibility that the wage differential applied by the employer is greater than the one allowing shock absorption (w ' in Figure 2)[14]. In formulas:

$$c = \beta \frac{w' - w_F}{w'} \tag{9}$$

where β is the parameter that measures workers' sensitivity to wage reductions due to employer moral hazard and is equal to $0 < \beta < 1$. When the level of unemployment is very high the value of the β parameter goes down, as the subjective cost of suffering of a negative wage differential due to the employer moral hazard becomes less important. β depends on u: when unemployment is low workers attach a high value to the risk of seeing their wages lowered[15]. Their utility is damaged in a relevant way by the risk of opportunistic wage cuts. When instead unemployment is high workers prefer not to loose their job and the value they attach to the cost of employer moral hazard decreases (β decreases, like the c).[16]

In table 2 we represent the relationship between the new value of the wage in case of negative shocks and the cost of employers moral hazard.

Table 2. Wage flexibility and employer moral hazard

Value of w_F	**Value of c**
$w' = w_F$	$c = 0$
$w_F = w_n$	$c = c_{\max}$
$w_n < w_F < w'$	$0 < c < c_{\max}$

[14] We don't assume that the employer fixes always sets the wage at the lowest possible level (w_n), even if this event can be plausible in many instances. We prefer instead to envisage a wage level (w_F)that is intermediate between the equilibrium because this represents a more general solution (actual wage level can show a probabilistic distribution ranging within the predefined range) and because the employer may decide to refrain from lowering wages down to the minimum possible level due the fear of reduced effort and sabotage by the employee. In particular, it can be relevant to evaluate the elasticity of effort to wage reductions. If this elasticity is higher than one, the employer has no convenience to lower the wage down to the minimum level.

[15] The value of this parameter is higher in case of aversion to risk, but changes for the employee, when changes the rate of unemployment.

[16] Here a dynamic analysis in which the value of β is endogenously determined may be needed. However, for simplicity we will assume that the value of β is given at any specific point in time.

The value of *c* is proportional to the wage gap in the presence of employer moral hazard: *c* is higher in case of severe asymmetric information since the bigger the information gap (and the related control costs) and the difficulty to set out complete contracts, the easier for the employer to lower the wage down to the minimum. At the beginning of the period the worker can choose between the two options described above: she compares (6) and (7) and chooses fixed wages if:

$$E(U)_A > E(U)_B$$

That is

$$pU(w^*-e)+(1-p)U(w^*-e-\varepsilon) > pU(w^*-e)+(1-p)U(w_F-e'-c) \quad (10)$$

If we assume utility functions that are linear in wages and effort, this amounts to:

$$(w^*-w_F) > (e-e') + (\varepsilon - c) \quad (11)$$

Workers estimates the probability p and (1-p) as given at the beginning of the period and their preference depends on the value of the cost of job switching and on the value of *c*. The choice of the worker is based on the comparison between the value of *c* and the value of ε. Obviously, these values are related to the rate of unemployment, to the severity of asymmetry of information and to the value the parameters d and β.

If there's no shirking, according to the results of efficiency wages models, the worker's utility calculated as the wage net the cost of effort is the same in the two cases[17], we obtain:

$$U(w^*-e) = U(w'-e') \quad (12)$$

The worker prefers the fixed wage if $c > \varepsilon$.

If the level of unemployment u is close to zero, also the value of ε is low and $E(U)_A > E(U)_B$ in all cases: workers will always choose fixed wages. However, the efficiency wage set-up implies that this is a purely theoretical hypothesis, as a non-zero level of unemployment represents a discipline device. So, we make the more realistic hypothesis that the employee makes his choice in a more complex way, calculating the payoffs in the alternatives cases in presence of unemployment. That is, the wage gain connected with wage rigidity must be greater than the sum of the additional effort required plus the cost of search of a new employment position net of the cost of employer moral

[17] We assume that the differential between wage and effort is the same under the hypothesis that the, at equilibrium, the ratio $\frac{w}{e}$ is a constant.

hazard. The costs associated with employer moral hazard reinforce the preference for fixed wages because they counterbalance search costs and make it much more likely that, at equilibrium, workers maximize their utility by preferring fixed over flexible wages. When the costs associated with EMH grow large it is even possible that the right hand side of the relation in (11) becomes negative. In this case this relation is always verified for negative shocks.

Table 3. Expected utility of the worker

Value of ε	**Value of c**		
	0	$0 < c < c_{\max}$	$c = c_{\max}$
0	$E(U)_A = E(U)_B$	$E(U)_A > (U)_B$	$E(U)_A > (U)_B$
$0 < \varepsilon < \varepsilon_{\max}$	$E(U)_A < E(U)_B$	$E(U)_A > E(U)_B$ $E(U)_A < E(U)_B$ $E(U)_A = E(U)_B$	$E(U)_A > E(U)_B$ $E(U)_A < E(U)_B$ $E(U)_A = E(U)_B$
$\varepsilon = \varepsilon_{\max}$	$E(U)_A < E(U)_B$	$E(U)_A > E(U)_B$ $E(U)_A < E(U)_B$ $E(U)_A = E(U)_B$	$E(U)_A > E(U)_B$ $E(U)_A < E(U)_B$ $E(U)_A = E(U)_B$

At the opposite extreme, when unemployment is very high, a situation that inflates the value of ε, it is likely that the employee wants to bear the cost of employer's moral hazard and prefers a flexible wage. The greater the rate of unemployment, the greater is the convenience to accept flexible wages (Table 2)[18].

A related reason why workers in capitalistic firms demand wage rigidity relates to the fact that the level of unemployment and the related cost of searching new jobs are more easily estimable,

[18] Indeed, in times of high unemployment and economic crisis as the present ones, it is not uncommon to observe workers accepting wage reductions, that is to accept wage flexibility.

even in case of negative demand shocks, while the cost of employer moral hazard is more unpredictable and, potentially, can be very large. These arguments help us understand why not risk aversion, but hidden information and hidden action connected with contract incompleteness and capitalistic ownership rights may be the most fundamental reasons why workers prefer fixed wages.

5. Cooperatives and capitalistic firms: a comparison

In worker cooperatives the different roles of principal and agent overlap in the same persons, since workers take both the position of employee (agent) and the position of member-owner (principal). This is because of the different property rights that give to worker members both residual control rights and residual rights of appropriation (Hansmann, 1996).

More specifically, the profit function of a generic firm j can be represented by the following equation:

$$\pi = X_c - wL - rK \tag{13}$$

where X_c are total revenues, wL is the cost of labour. The cost of capital rK is obtained by multiplying the interest rate r for the stock of existing capital.

In profit maximizing firms, the employer has an incentive to lower wages down to the minimum level in case of demand shocks and contracts of the type "flex and fixed wage employment" to increase the net value of π (13)[19]. This choice determines a value of *c max*, which induces employees to rarely accept such type of contract.

In cooperatives firms the principals (worker members[20]) maximize average income, i.e. the value of the produced net residual is fully shared among member-owners. Therefore, the members' income can be represented as:

$$\pi_s = \frac{\pi}{L} + w \tag{14}$$

In this case, workers are principal and agent and there's no incentive to lower wages lower than the value w'. In case of cooperatives where managers can lower the levels of wages, even if

[19] In particular the profit of the firm is higher in case of higher values of the difference $(w'-w_F)L$.

[20] Ben-Ner (1992) and Ben-Ner and Jones (1995) affirms that in worker-owned firms all participants are principals, which induces an internalization of conflict that is not attainable in conventional firms..

wages are lowered beyond the level w' to w_n, the workers are residual claimants, and therefore, the value of π is distribuited among them[21].

This means that in cooperative firms the cost c is not borne by the worker in the case of flexible wages and the utility function becomes:

$$E(U)_B = pU(w^* - e) + (1-p)U(w_F - e') \tag{15}$$

In this case workers prefer fixed wage (option 1) if:

$$E(U)_A > E(U)_B$$

That is:

$$[pU(w^* - e) + (1-p)U(w^* - e - \varepsilon)] > [pU(w^* - e) + (1-p)U(w_F - e')] \tag{16}$$

In this case c= 0 and $c > \varepsilon$ is never verified. Even if the level of unemployment u is very low, the value of the first part of the inequality will almost always be higher than the second: as shown in Table 4.

When considering utility functions that are linear in wages and effort, the left-hand side of inequality (15) is higher than the right hand side only when:

$$[(w^* - w_F)] > [\varepsilon + (e - e')] \tag{17}$$

[21] In cooperative firms managers are principals controlled by agents as they can exert voice. In particular, ownership rights in cooperatives allow workers to exert "voice" (Hirshmann 1970) when mechanisms of representation of worker objectives are put in place and managerial power is delegated as an on-going concern to specific individuals. One of the main aims of representation mechanisms is just to allow control and intervention by members when morally hazardous actions by delegated managers are detected. By contrast, in conventional firms workers are only allowed to choose the option "exit" or to exert limited "voice" through unionization (Sacconi, 1992). In this perspective, there is no incentive to undertake hidden actions.

Table 4. Expected utility of the worker in the cooperative firm	
Value of ε	**Value of c**
	0
0	$E(U)_A = E(U)_B$
$0 < \varepsilon < \varepsilon_{\max}$	$E(U)_A < E(U)_B$
$\varepsilon = \varepsilon_{\max}$	$E(U)_A < E(U)_B$

The relation (17) can be verified only when search costs are close to zero, that is the economy is near to full employment. It can also be verified when wage reduction following negative demand shocks are too wide. Finally, when considering effort, if the level of effort required to worker does not decrease in the presence of lowering wages (*e = e')* then the possibility to prefer fixed wages becomes more relevant. Our analysis mainly focuses on the role of search costs and unemployment risk. Hence, to simplify, we consider only limited fluctuation in wages and effort following negative shocks (w_F is lower, but close to *w**, and *e* is higher, but close to *e'*). In such cases, only search costs connected with the risk of unemployment become relevant and make the choice of fixed wages highly unlikely for at least three reasons: (i) search costs are likely to be non-negligible also in situations of low unemployment. This conclusion is also supported by the idea that search costs can be referred to contextual conditions, for example to the family situation, that do not imply only monetary externalities, but also relevant non-monetary costs; (ii) when unemployment is close to zero the active labour force is likely to increase because of the entrance on the labour market of groups of individuals that were once excluded; (iii) in the extreme case in which the equilibrium wage hits the participation constraint and, in the absence of unemployment, the labour market witnesses no new entrance, workers will be indifferent between fixed and flexible wages. However, even in this limit case, we can think that workers still prefer flexible wages because the risk of future negative shocks may imply a non zero probability of future unemployment.

Our arguments can help to disentangle long lasting debates concerning the behaviour of workers in respect to the creation of worker run enterprises. Some arguments (Bowles and Gintis, 1994) evidence problems related to risk-aversion in cooperatives. Since member-owners bear

entrepreneurial risk over and above financial risk, and also the risk related to the accumulation of firm specific human capital, they are not likely to create or become involved in worker cooperatives. In the light of the available empirical evidence and of our model this argument appears flawed for two main reasons: first, empirical evidence shows that employment relations are more stable in cooperatives than in conventional firms, implying that the position of workers may be riskier in profit maximizing firms than in cooperative. That is to say, risk averse workers may prefer the worker cooperative when wage fluctuations in the cooperative are not too wide. Second, in contexts of high unemployment search costs can be very high. In such cases we demonstrate that workers may more easily accept fluctuating wages in capitalistic firms as well, which implies bearing part of the entrepreneurial risk. Hence, risk taking is not alien to worker behaviour both in profit maximizing firms and in cooperatives. As said, the last statement is confirmed by recent experimental evidence (Bartling, Fehr, and Schmidt, 2011; Domhen and Falk, 2011).

6. Conclusions

We have shown that workers' choices concerning fixed *vis à vis* flexible wages depend on the quality of obtainable information on the economic conditions of the firm, on wage setting choices by the employer, and on past and present employer hidden actions, for example concerning investment plans. In turn, the quality of available information depends on the institutional structure within which workers exert their choices. As a consequence, even in the presence of workers characterized by the same intrinsic degree of risk aversion, it is possible to observe markedly different behaviours in different institutional contexts since the distribution of decision making power can impact on expected utility and induce workers to prefer fixed to flexible wages when the risk of opportunistic post-contractual reduction of wages.

Worker cooperatives represent the organizational model in which principal and agent coincide. In this case workers prefer flexible wages in all cases but the extreme one of zero unemployment, which can be taken as the extreme and most of the times unrealistic possibility. One relevant consequence of these behavioural predispositions is that worker cooperatives, by stabilising the level on employment and minimizing the risk of lay-off, favour workers' specific investments in human capital and the preservation of the accumulated stock of firm specific knowledge

At a macroeconomic level, cooperatives favours the stabilization of the rate of unemployment inducing workers to accept flexible wages. In the case of negative shocks the equilibrium level of the wage decreases as the NSC moves downward, but the level of unemployment stays the same (L* in Figure 2).This pattern of absorption of negative shocks can even favour the reduction of

unemployment since, in a dynamic perspective, negative shocks are followed by wage reduction more promptly in cooperatives than in capitalistic firms, and the lower level of wages can favour the employment of a larger number of worker when economic recovery is forthcoming.

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