Eastern Economic Journal, Volume XIII, No. 3, July–September 1987

Acceptable Contracts, Opportunism, and Rigid Hourly Wages

Roger A. McCain*

A major issue in the microfoundations of macroeconomics is the explanation of the apparent stickiness of the money wage over the business cycle. This stickiness is widely considered a necessary condition for models of the generally "Keynesian" family (Clower, Leijonhufvud) and is, in turn, offered as an explanation for the existence of involuntary unemployment in a market economy populated by purposive agents. During the last decade, a large literature on "implicit contracts" [Papers by Azariadis, Baily and Gordon founded the implicit contracts literature] have attempted to explain wage stickiness in terms of insurance. In this paper I set our an alternative model which shares the aim of the implicit contract models, accounting for hourly wage rigidity, and some of their assumptions. Familiarity with that literature and the criticisms (A complete survey would be beyond the scope of this paper. Several surveys have appeared: note Azariadis, 1979; Hart; Azariadis and Stiglitz, 1983.) which have been made of it are assumed and it is not reviewed in the interest of brevity. The first section illustrates the logic of the model with a simplified numerical example. The second section explores the implications of fully flexible-wage contracts and demonstrates that such a contract cannot be written in a way that can make acceptable to both employers and employees, given the usual behavioral assumptions. The third section considers three other contract forms more briefly, and concludes that, of the four contract forms considered, only a contract with inflexible hourly wages and flexible hours can be mutually acceptable. Thus the acceptable contracts model given here is offered specifically as an explanation for rigid hourly wages. The last section summarizes and concludes.

IMPLICIT OR ACCEPTABLE CONTRACTS?

Early implicit contract theory (Azariadis, 1975, Baily, Gordon) relied on worker risk-aversion and insurance by the employer to explain rigid wages. However, as critics (Akerlof and Miyazaki, e.g.) and more recent work (Azariadis, 1983, Azariadis and Stiglitz, Chari, Green and Kahn, Grossman and Hart, Hart) have shown, risk-aversion and insurance are not sufficient or necessary to explain rigid wages.[1]

Implicit contract models often assume that some parties to the contract may behave opportunistically (Baily, e.g.). This opportunistic behavior may take the form of mispresentation (Azariadis, 1983, Azariadis and Stiglitz, Chari, Green and Kahn, Grossman and Hart, Hart). Opportunism is the exploitation of a prior commitment by the other party. This entails

*Professor, Fordham University and Visiting Professor, Brooklyn College, CUNY. I am indebted to anonymous referees for comments and to H. Lorie, for extensive and useful discussions on the implicit contract literature. Any errors or shortcomings in the paper are atrributable to the author.

A longer version of the paper summarizes the implicit contract literature and points out the divergencies of this paper from that literature in detail. The longer version also includes some formal models of reputational costs, and concludes that plausible reputational mechanism cannot make "implicit" contracts enforceable. This longer version is available from the author on request.

that decisions must be made of two or more stages, and further that a rational decision-maker will try to protect against opportunism by the other party in subsequent stages. These assumptions are sufficient to explain wage rigidity,[2] even if there is no uncertainty as to the state of the world, and thus nothing to insure. To understand the implications of opportunism, we must consider the contract as a game in extensive form (Kuhn 1953). The following highly simplified numerical example illustrates the logic of the model.

Following Okun (1981), assume that the worker must pay a "job market toll" whenever he enters the labor market, either for the first time or to change jobs. Let the job market toll be $100. The game proceeds as follows. 1) The employers offer a contract which specifies that the wage will be either $100 or $200 and that this will be determined at the employer's discretion at the third stage of the game. 2) The employee accepts or rejects the contract. 3) The employer specifies which of the two wages will be paid. 4) The employee decides whether to remain or quit, before anything is produced. 5) If he remains, an output with a sales value of $300 is produced. Assume also that the worker's alternative wage is $150. Thus, if the worker initially declines the contract, his net payoff is 50. If the worker either refuses the contract or quits, the employer makes nothing; but if the worker accepts, and then quits, he must pay a second $100 job market toll, and thus his net payoff is 150–200 = −50. If the worker accepts, and then remains, his payoff is the wage minus the $100 toll, and the employer's payoff is $300 minus the wage. The game is illustrated in "game tree" form (Kuhn) in Figure 1, and in normal form in the payoff table, Table 1.

Now, suppose that the worker accepts the contract. This is a commitment: the top two cells in the payoff table are no longer available to him. The employer, knowing this and intending to maximize profits, specifies a wage of $100, leaving the worker with a best payoff of zero. Anticipating all this, the worker rejects the contract. A contract of this form is not an acceptable contract to the worker. Thus the payoff is (50, 0). Yet the payoff at the lower right, (100, 100) is Pareto preferable to this.

Suppose, however, that the institutions and unspoken agreements which determine the commitment structure of the game are rearranged, so that the employer must commit to a wage before the worker decides on acceptance or rejection. Then the employer can anticipate that a wage of $100 will not be accepted—it is below the supply curve and will offer $200, yielding the Pareto-optimal outcome.

One thing which is missing from the simple example is worker opportunism. It may be that worker opportunism provides reasons (a la Baily) why the employer is unwilling or unable to commit initially to a wage of $200. However, further discussion of this point is beyond the scope of this paper.

Several other points do require further consideration, however. First, although it is interesting *per se* that wage rigidity can occur in a certainty model, the world is not certain and uncertainty (or, more precisely, risk) should be allowed for. Second, wages are divisible, not limited to two discrete levels. Third, the model implicitly assumes that the working day is discrete, but hours, too, are variable and divisible. This is important, since even if day wages were rigid, the employer could cut wages by posting an increase in hours.[3] These matters are taken up in the following sections, in the context of a formal optimization model.

AN UNACCEPTABLE CONTRACT

Four contract forms will be considered:
1) Day-wage contracts with wages and hours flexible *ex post;* 2) Day-wage contracts with flexible hours and daily wages fixed *ex post;* 3) Hourly-wage contracts with hours and hourly wage flexible *ex post;* 4) Hourly wage contracts with flexible hours and wages fixed *ex post.*

With the possibility of opportunism on both sides of the market, only contracts of form 4) will be acceptable to both employers and employees. This section considers the flexible day-wage contract at some and concludes that it is unacceptable.

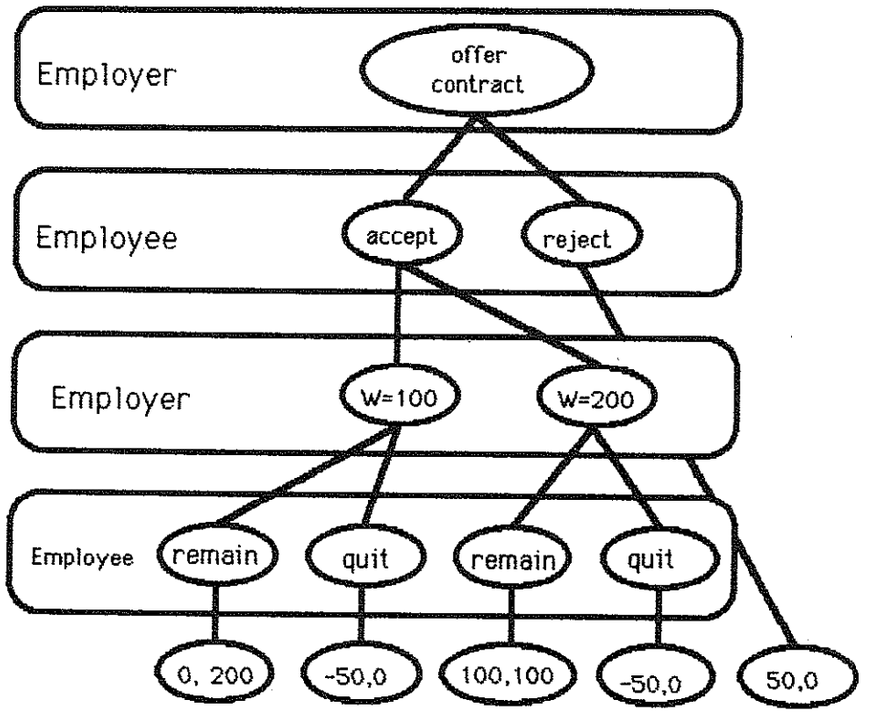

Figure 1

Table 1

Employer's Strategy

Employee's Strategy	w=100	w=200
refuse	50,0	50,0
accept and quit	-50,0	-50,0
accept and remain	0,200	100,100

The variables of the model are as follows:

L_i, the number of persons employed in state i

H_i, the hours of work per day, for a representative worker, in state i

Q_i, the total revenue product in state i

M, the number of persons hired ex ante, a variable chosen ex ante

N_i, the number of persons hired *ex post* in state i

a, the employer's labor market toll for hiring *ex ante*

b, the employer's labor market toll for hiring *ex post*

T, the employee's job market toll for reentering the labor market *ex post*. We may assume that the same toll is paid when the employee enters the labor market *ex ante,* but this is a sunk cost before the game begins and so is ignored. T is measured in units of utility.

w_i, the wage paid in state i, if the wage is flexible

W, the wage paid in all states, if the wage is inflexible

U_i, the representative employee's utility in state i

p_i, profits in state i

x_i, the representative worker's daily wage income

U_o, the representative employee's second-best alternative, *ex post* gross of T.

V_i, the employer's utility in state i

z_i, the probability of state i

n_i, the probability of being laid off in state i

D, the dole, that is, the income in case the employee is laid off. The utility of being laid off is denoted by U(D) and it is assumed that $U(D) < U_o$.

Some equations of the model follow, with explanations.

$$Q_i = f^i(L_i, H_i) \tag{1}$$

Here, $f^i(.\,,.)$ is an ordinary production or revenue function, expressing revenue possibilities in state i. It is not assumed that the function is multiplicatively separable in L_i and H_i, i.e. it is not assumed that total labor input can be written as L_iH_i though this assumption would make no difference to the model.

$$U_i = U(H_i, x_i) \tag{2}$$

$U(.\,,\,.)$ is an ordinary utility function. Daily wage income may be the product of the hourly wage and daily hours, or simply the daily wage, depending upon the contract form.

$$\text{If } N_i > 0, \text{ then } U(H_i, x_i) \geq U_o \tag{3}$$

This is the minimal wage-hours package to recruit new employees and expresses the reasonable condition that the employer cannot force wages down and hours up, opportunistically, below the workers second-best alternative, and at the same time recruit new workers. The toll, T, is not deducted from the second-best alternative in this case on the grounds that these workers may be hired for the first time—upon paying only that initial toll which all workers pay on entering the labor force for the first time.

$$U(H_i, x_i) \geq U_o - T \tag{4}$$

This constraint states the necessary condition to retain those who were recruited ex ante. If the wage-hours package should be worse than the second best alternative minus T, the cost of reentering the labor market, then the labor force of the firm will depart. (Of course, if 4. is violated then 3. is also violated, so no new employees can be recruited to replace them).

$$L_i \leqq M + N_i \tag{5}$$

In this case, the inequality is appropriate because there might be *ex post* lay offs.
The condition for the contract to be acceptable to the employees is that

$$E(U_i) = \sum_{i=1}^{m} z_i\,((i - n_i)U(H_i, x_i) + n_iD) \geqq U_o \tag{6}$$

Where it is assumed that there are m states of the world. This acceptability condition is the same as in the implicit contracts literature. Note that in the implicit contracts literature, (6) would be imposed as a constraint on the maximization of profits by the employer. However, it seems clear that (6) could not be enforced at law—it is an *ex ante* condition and cannot be verified by any reference to *ex post* realizations. (The employer can always plead that there were contingencies not realized in fact which would have offset any *ex post* shortfall from the expected value). Thus, following the guideline that contracts not enforceable at law are not enforceable by reputation either, this condition is not imposed as a constraint on the *ex post* policies of the employer but serves as a standard for comparison to evaluate the acceptability of contracts. In addition, the following condition is assumed necessary if the contract is to be acceptable to employees:

$$x_i > 0, \text{ for all i} \tag{7}$$

This assumption reflects a judgment that the marginal utility of income becomes very large as income approaches zero and rules out certain corner solutions in the maximum problems to follow, in which a wage of zero would hardly be a plausible proposition in an acceptable contract although it would be a technical possibility. The acceptability condition for employers is simply $M > 0$. It too, serves to exclude some nonmeaningful corner solutions.

On the basis of these definitions and equations, consider first a contract of form 1; that is, a day-wage contract with the hours and wage flexible *ex post*. Profit in state i is determined by

$$p_i = f^i(H_i, L_i) - w_iL_i - aM - bN_i \tag{8}$$

hence the expected value of the utility of profit is

$$E(V) = \sum_{i=1}^{m} z_iV(f^i(H_i\,, L_i) - w_iL_i - aM - bN_i) \tag{9}$$

The derivative of $V(\cdot)$ is assumed always to be positive. Equation (9) will be maximized subject to the constraints of (3), (4) and (5) expressed as

$$N_i\,(u(H_i, x_i) - U_i) \geq 0 \tag{10}$$

This constraint expresses (3), since the inequality in (3) holds whenever N_i is positive, but not when N_i is zero. Like all variables in this analysis, N_i is constrained to be nonnegative. All constraints hold in each state of the world separately.

The details will be left to a mathematical appendix available on request. The major

theorem proved in that appendix is that equation (6), the worker's acceptability condition, cannot be fulfilled. This follows from the fact that the maximum problem has no interior solution, and corner solutions correspond to states of the world in which employers act opportunistically and workers get less than their best *ex ante* alternative. There are, however, no states in which workers get more than their best alternative to offset these. The states in which we might expect the workers to get more than the second best alternative for those in which the variables are determined as an interior solution; thus these workers get exactly their second best alternative. Since they get their alternative in some states and less than the alternatives in others, their expected utility can only be less than their *ex ante* second-best alternative; thus, they will not accept a contract which provides no means for forestalling employer opportunism. What the theorem demonstrates is that the day-wage contract cannot be mutually satisfactory. If it is satisfactory to the employers, i.e. $M > 0$, then there must be some states of the world in which either lay-offs or shutdowns occur. If there are not, then the employer will increase M until there are some such states. The existence of layoffs is enough to reduce workers below their second-best alternative, in those states; but in fact layoffs do not occur until the wages have been cut and the hours increased within the constraint necessary to retain the existing labor force. Thus even those who remain employed in a layoff state are worse off than their second best alternative, by the amount of the market toll for re-entering the labor market, T units of utility. In a Baily-type implicit contracts model, this shortfall would be offset by excess of U over the second-best alternative in favorable states. That derives from the imposition of 6. as a constraint. In this model, in the absence of an enforceable contract for wages which vary by contingency, workers have no trustworthy assurance that any such offsetting excesses will ever be paid. Accordingly, they do not accept a contract in which the wage is flexible.

OTHER CONTRACT FORMS

Consider next a contract of form (2), with the daily wage constrained to be the same in all states of the world. Thus in the place of the state-specific wage variable w_i we have W, chosen *ex ante*. One further assumption is required to establish that this contract is unacceptable. The assumption is that the marginal productivity of hours is always positive. $f_{H_i}(L, H) > 0$, for all i.[4,8]

What has been shown so far is that day-wage contracts will not be acceptable whether the wage is sticky or flexible. The "stylized fact" is that day-wage contracts are uncommon in developed countries, so the model agrees with experience so far as casual empiricism permits us to judge. Contract form (3), an hourly wage contract with flexible wages will result in

$$x_i = w_i H_i \tag{12}$$

and in place of (8) substitute

$$p_i = f^i(H_i, L_i) - w_i H_i L_i - aM - bN_i \tag{13}$$

and replace (9) with

$$E(V) = \sum_{i=1}^{m} z_i V(f^i(H_i, L_i) - w_i H_i L_i - aM - bN_i) \tag{14}$$

The unacceptability of this contract follows by arguments which parallel those for forms (1) and (2).

Consider next a contract of form 4, i.e. one in which the hourly wage is constant over states.

Substitute W for w_i in equations (12–14) to arrive at a different result: viz. an interior solution to the optimum problem, at which an acceptable contract can occur.

On the one hand, wages cannot be reduced in unfavorable states, because of the fixed-wage requirement of the contract. On the other, while hours can be increased, the employer can be restrained from increasing them very greatly by the hourly wage contract. An increase in hours will increase profits only up to the point at which the marginal revenue product of hours is equal to the marginal cost of hours, which is the hourly wage times the number of employees. In some states, this can occur at a wage-hours package which makes the representative worker better off than the best alternative would be. These states may offset those in which the representative worker is worse off than the best alternative, so that the expected utility may be at least equal to that best alternative; thus the contract may be acceptable. (Okun, 88–90)

It has not been established that a fixed hourly wage contract is acceptable. Indeed, that cannot be established as a general proposition for any contract form, since it depends on the specific value of the wage and the expected profit of the employer, and potential economic activities can exist which could not be profitable under any contract form. In such cases no acceptable contracts can exist. What we have established is that the fixed hourly wage contract may be acceptable in circumstances in which the other three contract forms cannot be—that arguments which establish the unacceptability of the other three contract forms fail to establish the unacceptability of the fixed hourly wage contract. This is the most that we may hope to establish by a theoretical argument. The argument of this section leads to the following prediction: the day-wage contracts will not be observed, and that hourly wage contracts with flexible wages will not be observed either. These predictions agree precisely with the stylized facts which the microfoundations of macroeconomics set out to explain by "implicit contracts."

Note that no assumption has been made concerning risk aversion. The utility functions assumed are general and may be specified in such a way as to be consistent with risk neutrality. In the case of the employer, therefore,

$$V(p) = kp \tag{15}$$

in which k, constant, is an acceptable utility-of-profits function, consistent with employer risk neutrality. Analogously, for employees we would write

$$U(H, x) = cxg^*(H) \tag{16}$$

with c constant, so that utility may be non-linear in H even though it is linear in x. The linearity of U in x would mean that employees are risk-neutral. Again, this risk-neutral specification is quite consistent with the model, and no assumption is made that employees are risk-averse.

CONCLUDING COMMENT

It has been shown that, in the presence of "job market tolls" and employer and employee opportunism, that among four simple contract forms covered only that with a sticky hourly wage is acceptable. This results from the job market toll, T, and the probability that there will be some states in which the employer does not need to consider hiring new employees, but it does not depend upon the magnitude of that probability nor on the magnitude of T. This is, I suggest, a remarkably strong result. It means that a model in which T is assumed to be zero, or in which opportunism is ignored, cannot be a "good enough" approximation in a world in which T is positive and opportunism possible. (Akerlof, 1985, provides parallel instances in models of other

kinds). It does no good to defend such an "approximate" model by appeal to a judgement that T is small or opportunism improbable or both. That judgment, which is plausible on its face, is without consequences for the acceptability of wage and hour contracts.

In economics, the magnitude of the effect often depends upon the magnitude of the cause, and that means that there are many small complications in economic theory which may safely be ignored. Opportunism is not one of them. In the model of acceptable contracts, the magnitude of the effect (unacceptability) does not depend on the magnitude of the cause (T or the probability of opportunism). In order to be even *approximately* correct, a model of the wage-hours contract must take opportunism explicitly into account, along the lines developed here.

FOOTNOTES

1. Clive Bull addresses the enforceability question and argues that "standard" implicit contracts are unenforceable. His "answer," however, is that contracts may not need enforcement if employers and employees are bilateral monopolists. This is not to answer the question but to substitute another question. Benjamin Klein assumes that there is specific human capital which increases the marginal productivity of the employees provided that they continue in the same job; this leads him (without formal analysis) to the conclusion that contracts will be incomplete and partly implicit. He stresses that the terms of contracts may include provisions which protect employees from being "held up" by the employer, i.e. (in my terms) which forestall employer opportunism, and conjecture that wage rigidity may have that role.
2. The model is more general, and can be extended to other dimensions of the work process than hours and pay, with some consequent insights about the special character of labor contracts.
3. A reading of Marx on the subject of hours and wages might have suggested this. Marx' discussions always presuppose day-wages, however.
4. It should be observed that this assumption, while plausible, is not self-evidently correct. An acceptable day-wage contract could be obtained with a zero marginal productivity of hours. It may be shown, however, that this contract is necessarily Pareto-inferior to some hourly-wage contracts with inflexible wages, so the possibility is ignored.

REFERENCES

Akerlof, G.A. and J.L. Allen, "Can Small Deviations from Rationality make Significant Differences to Economic Equilibria"?, *American Economic Review* v. 75, n. 4 (Sept., 1985), pp. 708–720.

Akerlof, G.A. and H. Miyazaki, "The Implicit Contracts Theory meets the Wage Bill Argument," *Review of Economic Studies* v. 47 (Jan., 1980), pp. 321–338.

Azariadis, Costas, "Implicits Contracts and Related Topics: A Survey," in Z. Hornstein et al, Eds, *The Economics of the Labor Market* (London: HMSO, 1979).

Azariadis, Costas, "Implicit Contracts and Unemployment Equilibria," *Journal of Political Economy* v. 83, no. 6 (Dec., 1975), pp. 1183–1202.

Azariadis, Costas and Joseph E. Stiglitz, "Implicit Contracts and Fixed-Price Equilibria," *Quarterly Journal of Economics* v. 98, supplement, (1983), pp. 1–22.

Azariadis, Costas, "Employment with Asymmetric Information," *Quarterly Journal of Economics* v. 98, supplement, (1983), pp. 157–173.

Baily, M.N., "Wages and Employment under Uncertain Demand," *Review of Economic Studies* v. 41, no. 1 (1974), pp. 37–50.

Bull, Clive, "Implicit Contracts in the Absence of Enforcement and Risk Aversion," *American Economic Review* v. 73, no. 4 (Sept., 1983), pp. 658–671.

Chari, V.V., "Involuntary Unemployment and Implicit Contracts," *Quarterly Journal of Economics* v. 98, supplement, (1983), pp. 107–122.

Eckalbar, J.C., "The Stability of Non-Walrasian Processes: Two Examples," *Econometrica* v. 48, no. 2 (March, 1980), pp. 371–386.

Gordon, Donald, "A Neoclassical Theory of Keynesian Unemployment," *Economic Inquiry* v. 12, no. 4 (Dec., 1974), pp. 431–459.

Green, Jerry and Charles Kahn, "Wage-Employment Contracts," *Quarterly Journal of Economics* v. 98, supplement, (1983), pp. 173–188.

Grossman, Sanford J. and O.D. Hart, "Implicit Contracts under Asymmetric Information," *Quarterly Journal of Economics* v. 98, supplement, (1983), pp. 107–122.

Hall, Robert and Edward Lazear, "The Excess Sensitivity of Layoffs and Quits to Demand," *Journal of Labor Economics* v. 2, no. 2 (April, 1984), pp. 223–257.

Hart, Oliver, "Optimal Contracts under Asymmetric Information: An Introduction," *Review of Economic Studies* v. 50 (1983), pp. 3–35.

Klein, Benjamin, "Contract Costs and Administered Prices: An Economic Theory of Rigid Wages," *American Economic Review* v. 74, no. 2 (May, 1984) pp. 332–338.

Kuhn, H.W., "Extensive Games and the Problem of Information," in Kuhn and A.W. Tucker, *Contribution to the Theory of Games* (Princeton: Princeton University Press, 1953). (Annals of Mathematics Studies, no. 28), pp. 193–216.

Leijonhufvud, Axel, "Keynesian Economics and the Economics of Keynes," (New York, Oxford University Press, 1968).

Lorie, Henry, "Optimal Wage Setting and Unemployment," unpublished.

McCain, Roger A., "A Theory of Codetermination," *Zeitschift fur Nationalokonomie* v. 40, no. 12 (1980) pp. 65–90.

Meade, James, The Theory of Indicative Planning (Manchester, Manchester University Press, 1970).

Okun, Arthur, Prices and Markets, (Washington: Brookings Institution, 1981).