IMPLICIT CONTRACTS AND REPUTATIONS*

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1. Introduction

A great deal of attention has been paid to the implicit contract theory since Azariadis (1975) and Baily (1974). The basic idea of this theory is that less risk-averse firms find it profitable to offer sticky wages to more risk-averse workers and to insure them against fluctuations in the firm's product demand. In this view, wage stickiness prevails as an outcome of risk-sharing arrangements against fluctuations in the firm's product demand. Unfortunately, if firms and workers have symmetric information about the state of the world, the implicit contract theory cannot explain that part of unemployment which is not predicted by the standard Walrasian model. Several authors, however, have recently shown that this conclusion is no longer true once firms are assumed to have better information than workers about the state of the world. In particular, Grossman and Hart (1981) (1983) and Hart (1983) reach the remarkable conclusion that unemployment will be greater in the implicit contract model than in the Walrasian model if firms are risk averse under asymmetric information.

In spite of these developments, much effort has not been made to justify the two critical assumptions of the implicit contract theory: (1) The firm is committed to any agreed-upon contracts until the beginning of the next contracting period, and (2) the worker is not permitted to move any ex-post job opportunities outside the firm of his ex-ante contract. If the first assumption is violated, the firm may default the ex-ante contract in some unfavorable states where the wage rate exceeds the marginal product of labor. On the other hand, if the second assumption does not hold, the worker may quit the firm when he enjoys higher utility by joining another work outside the firm.

To justify these two assumptions, we might think of possibility of legal enforceability. Nevertheless, about the legal basis of contracts, we observe in reality that contracts are enforceable on firms, and not on workers; in other words, the bondage and discipline of labor is not lawful. Furthermore, contracts are not enforceable on firms either if they are written in the implicit form.

Several recent papers have recognized that care of both firms and workers in building their reputations under repeated contracts plays the role of a private device for assuring contract performance in the absence of legal enforcement (see Carmichael (1984) and Wilson (1986)). This private mechanism relies upon the values of repeated contracts to firms and workers as a means of preventing nonperformance.

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If both firms and workers realize the role of reputation for enforcing contractual promises, these two contracting agents arrange the labor contracts so as to motivate themselves to honor their promises. Then it is not surprising if an optimal labor contract is strongly impinged by the nature of the reputational mechanism. It thus becomes important to discuss whether an optimal contract is efficient under the reputational mechanism. If the reputational mechanism cannot fully assure the efficiency of an optimal contract, we further need to ask whether the optimal contract causes underemployment or overemployment. The recent work of Newbery and Stiglitz (1987) has examined the problem of firm's reputation. However, to avoid complexity, they restrict their analysis to the class of linear implicit contracts. Furthermore, they assume that the reputation cost (or the value of repeated contracts to firms) is independent of what contract arrangements are made between the firm and the workers.

The purpose of this paper is to explore a role of firm's reputation in the contractual labor market where the firm cannot commit itself to any agreed-upon contracts. In contrast to Newbery and Stiglitz, we discuss the class of general implicit contracts and scrutinize the case that reputation cost is dependent on the contract arrangements. We consider a long-term contract model in which, if the firm defaults the contract arrangements, the firm acquires a bad reputation and cannot make any contracts in subsequent periods. The worker is assumed to behave as if he knows the production function of the firm. Once the firm offers a long-term contract, the worker puts himself in the position of the firm, thereby calculating whether the firm's benefits gained from honoring the contract are greater than the costs involved. The long-term contract can then be organized so as not to be defaulted by the firm. The similar kind of reputational mechanism has been dealt with the literature on the quality choice of products (see Klein and Leffler (1981), Shapiro (1982) (1983) and Allen (1984)).

The plan of the paper is as follows. Section 2 develops a long-term contract model under symmetric information where the realization of the state of the world becomes known to both firms and workers. The striking result in this section is that reputation by itself enforces efficient behavior on firms even though the firm cannot commit themselves to any agreed-upon contracts; in particular, an optimal contract is characterized by the efficient level of employment. This finding differs from the results of the recent articles on reputational markets because their results suggest that reputation by itself will not restore efficiency (see Carmichael (1984) and Wilson (1986)).

Section 3 discusses a long-term contract model under asymmetric information in which firms have better information than workers about the state of the world. We assume throughout this section that firms are risk neutral under the environment based on Grossman and Hart (1983). Using this framework, Grossman and Hart show that no distortion exists if firms can commit

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1) Several other papers have also examined a role of reputation in the labor contract market. See Grossman (1977) and Carmichael (1984). In particular, the reputational model of Carmichael presumes that workers base their expectations of future wage and employment levels on actual past values; and that firms know this and take it into account when they set current wage and employment levels. Although the reputation formation does not follow a rational principle such as the Bayes rule, his analysis sheds light on many aspects of the modern labor market, including involuntary underemployment and sticky wages.
themselves to implement any agreed-upon contracts. In contrast, we can prove that care of firms in building their reputations involves the possibility of underemployment unless firms can commit themselves to implement any agreed-upon contracts. Furthermore, if underemployment occurs, an optimal contract in the reputational market provides the amount of severance pay which is not enough to ensure risk-averse workers from the risk of layoff. This result implies that under the optimal contract workers prefer being employed to being laid off. Our analysis therefore leads to equilibria in which there are both inefficiently high unemployment (underemployment) and involuntary unemployment.

In the standard implicit contract model with severance pay, workers are indifferent about whether they are to be rationed or laid off. To explain the phenomenon of involuntary unemployment, Moore (1985) allows workers to have better ex-ante information about their spot market opportunities; but he finds a tendency towards involuntary retentions rather than involuntary layoffs. Mookherjee (1986) explores the alternative hypothesis that firms cannot perfectly observe the effort decisions of employed workers in the long-term contract relation. However, he concludes that unobservability of worker effort is unlikely to provide a robust explanation of involuntary layoffs in the long-term contract. In contrast, our result suggests that care of firms in building their reputations provides a theoretical explanation of involuntary layoffs.\footnote{For the discussion of the restrictive assumptions of the Mookherjee's model, see Osano (1988). With the assumption of asymmetric information and no severance payment, Oswald (1986) shows the existence of equilibria characterized by involuntary unemployment and inefficiently high unemployment. However, our model can yield the same results without excluding the presence of severance pay.}

The final section contains some concluding comments and discusses future research.

2. The Symmetric Information Model

Consider a (representative) firm which employs one worker at most. The output of the worker in each period is given by an independently and identically distributed random variable, $s$, if he is employed. Let $F$ be a distribution function of $s$ that satisfies $F(s) = 0$ and $F(\bar{s}) = 1$ for $s < \bar{s}$. The distribution function $F$ has a continuous density function $f(s)$, which is positive for $s \geq s \geq \bar{s}$.

At the beginning of each period before $s$ is not realized, neither actual production nor employment occurs. At the end of each period after $s$ is realized, production and employment can be carried out if a labor contract has been signed. If production does occur, the firm employs the worker and produces output $s$. If production does not occur, the firm lays off the worker and produces no output.

The worker has no consumption good endowment, but he supplies one unit of labor inelastically in each period. Since he has no access to the capital market, he consumes whatever he earns in each period. If the worker is employed, his utility is $U(Y - R)$; and if he is unemployed, his utility is $U(Y')$. Here, $U$ is a von Neumann-Morgenstern utility function; $Y$ ($Y'$) is worker’s income if he is employed (unemployed); and $R$ represents worker’s disutility of effort, which is assumed to be $s \leq R \leq \bar{s}$. The utility function $U$ is defined and twice differentiable on $R_+$. It is assumed that $U' > 0$ and $U'' < 0$ on $R_+$. Thus the worker has risk averse preferences.
In what follows, we assume that both the firm and the worker know the probability distribution function $F$ and the utility function $U$. It is particularly assumed in this section that everyone will observe output $s$ at the end of each period.

The model is an infinite-horizon one starting with period 0. At the beginning in period 0, the firm decides whether to sign an infinite-horizon long-term contract with the worker. In general, we can consider nonstationary long-term contracts instead of stationary ones. However, little can be said about nonstationary long-term contracts. Thus we will focus our attention on stationary long-term contracts consisting of a set of functions, $[w(s), y(s), L(s); s \leq s \leq \bar{s}]$. These contracts indicate for each state (1) whether the worker is employed ($L(s) = 1$) or unemployed ($L(s) = 0$); (2) that he receives wages $w(s)$ if employed, and severance pay $y(s)$ if not employed.

Under stationary long-term contracts, the present value of stream of expected profits of the firm is described by

$$\text{(1)} \quad r^{-1} \mathbb{E}[L(s)[s - w(s)] - [1 - L(s)]y(s)],$$

where $r$ is a discount rate and $\mathbb{E}$ an expectation operator. The present value of stream of expected utility of the worker is also written in the form

$$\text{(2)} \quad r^{-1} \mathbb{E}[L(s)U(w(s) - R) + [1 - L(s)]U(y(s))].$$

Once the worker signs a contract with the firm, he is assumed to be unable to work anywhere else outside the firm at the ex-post date in each period; in other words, he cannot join any contracts with the other firms until the beginning in the next period. This presumption can be justified if the worker incurs mobility costs when moving to the other firms at the ex-post date in each period.

On the other hand, the firm is not committed to any agreed-upon contracts: The firm may default on the agreed-upon contract at the end of each period. If a firm defaults on the agreed-upon contract, then the news becomes known to workers through market surveys, conversations with friends, and so on. The simplest way to model the information-dissemination process is to assume that, until the beginning in the next period, all workers are informed whether the firm defaults on the contract. In this process, if a firm ever violates the agreed-upon contract, the firm acquires a bad reputation because the news the firm cheats becomes widely known. Once a firm has a bad reputation, workers expect that the firm will default on the ex-ante contract. Thus the cheating firm cannot make any ex-ante contracts in subsequent periods under the assumed information-dissemination process.

In the analysis that follows, the firm is assumed to shut down its operation after breaking the contract. The firm then finds it profitable to maintain the reputation of honoring contracts if and

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3) Relaxation of the assumption of $L(s) = 0$ or 1 does not modify our conclusion, because the production function is linear in our model.


5) Instead of shutting the operation, the firm may hire workers in the spot market. Even in this case, our subsequent arguments still hold if the present value of stream of firm's expected profits from hiring workers in the spot market is equal to zero.
only if, at the end of each period, the firm enjoys a greater present value of stream of expected profits under the long-term contract than under the shutdown.

We now proceed to examine an optimal stationary long-term contract which maximizes the firm's present value of stream of expected profits, (1), subject to (i) the reservation utility constraint and (ii) the reputational constraint that prevents the firm from defaulting the contract.

We begin with considering the two constraints of the firm's maximization problem. We first introduce the reservation utility constraint which forces the firm to match or exceed market offers in order to retain workers in each period. This constraint is

\[ r^{-1} E\{L(s)[w(s) - R] + (1 - L(s))y(s)\} \geq \tilde{V}, \]

where \( \tilde{V} \) is a market-determined present value of stream of expected utility of workers.

We next discuss the reputational constraint which induces the firm to honor the contractual relation. We find from the previous argument that the firm prefers to maintain the reputation of honoring contracts if and only if, at the end of each period, the firm enjoys a greater present value of stream of expected profits from being on the long-term contract than from stopping operation. Given stationarity, at the end of each period, the present value from being on the long-term contract is evaluated as follows:

\[ \pi(s) = \{L(s)[s - w(s)] - [1 - L(s)]y(s)\} + r^{-1}(1 - r)E\{L(s)[s - w(s)] - [1 - L(s)]y(s)\}, \]

where the first term represents the ex-post single-period profits realized at the end of the period, and the second term is the present value of stream of expected profits from the next period onward if the firm continues the contract relation.\(^6\) Note that specification (4) is valid for both \( L(s) = 0 \) and \( L(s) = 1 \).

The reputational constraint can now be described using (4). The firm prefers to honor the contract if and only if, for each state,

\[ L(s)[s - w(s)] - [1 - L(s)]y(s) + r^{-1}(1 - r)E\{L(s)[s - w(s)] - [1 - L(s)]y(s)\} \geq 0. \]

We assume throughout that the firm desires to continue in the contract relation if it is indifferent to the firm whether to default or not.

Farmer (1985) and Kahn and Scheinkman (1985), incorporating a bankruptcy constraint into the implicit contract model, lead us to the interesting conclusion that limited liability generates underemployment under asymmetric information. Their bankruptcy constraint implies that, in any state of nature, the ex-post loss of the firm can be no greater than the collateral of the firm which is exogenously given. It might be thought that reputational constraint (5) is similar to such a limited liability type. However, this view is rather misleading because reputational constraint (5) includes those terms of future expected profit stream which depend on the endogenous contract arrangements determined between the firm and the worker. Furthermore, since

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\(^6\) In the subsequent analysis, under an optimal stationary long-term contract, the present value of stream of expected profits of the firm is assumed to be greater than zero. Then the value of the second term in (4) turns out to be greater than zero because the value of this term equals the present value of stream of expected profits from the next period onward. Thus the firm will have no incentive to stop the contract relation at the beginning in the next period.
the worker is risk neutral in Farmer and the firm adjusts the labor input by work sharing alone in Kahn and Scheinkman, the worker is indifferent to the distribution of payment across states of nature; thus the unemployment is always voluntary. On the other hand, in our model, the worker is risk averse and the firm is allowed to layoff the worker, so that we can consider the possibility of involuntary unemployment in this framework.

Now, the firm's maximization problem with respect to \([w(s), y(s), L(s); s \leq s \leq \bar{s}]\) is

\[
\text{Max } r^{-1} \mathbb{E} \{ L(s) \left[ s - w(s) \right] - \left[ 1 - L(s) \right] y(s) \},
\]

subject to (3), (5), and \(L(s) = 0 \) or 1.

We are in a position to characterize an optimal stationary long-term contract by solving maximization problem (6). If the firm always honors the contract, the firm can drop reputational constraint (5). As proved in Grossman and Hart (1983), an optimal stationary long-term contract then turns out to be the first-best one: (i) worker's marginal utility of income is fixed across all states of nature, i.e. \(w(s) - R = y(s) = U^{-1}(rV)\), where \(U^{-1}\) is an inverse function of \(U\), and (ii) the rule of employment is efficient, i.e. the firm employs the worker if and only if the output of the worker, \(s\), is greater than or equal to worker's disutility of effort, \(R\).

However, if the firm has some possibility of defaulting on the contract, it is not straightforward to see whether contracting parties choose as the best strategy the efficient rule of employment. Nevertheless, we can prove that an optimal contract satisfies the efficient rule of employment. Suppose that unemployment (i.e. \(L(s) = 0\)) occurs for a state \(s'\) in which \(s' > R\). Then the firm's profits in \(s'\) are \(-y(s')\). Increase \(L(s')\) to 1, and adjust \(w(s')\) so that the firm's profits at \(s'\) remain constant. This procedure is expressed in the form

\[(7) \quad s' - w(s') = -y(s'),\]

which verifies that reputational constraint (5) is not violated. However, worker's expected utility must increase because

\[
(8) \quad U(y(s')) = U(w(s') - s') < U(w(s') - R).
\]

The final inequality is due to the assumption that \(s' > R\). These findings lead to an ex-ante Pareto improvement, thus contradicting the optimality of the contract. Conversely, suppose that the worker is employed (i.e. \(L(s) = 1\)) for a state \(s''\) in which \(s'' < R\). Reduce \(L(s'')\) to 0, and adjust \(w(s'')\) so that the firm's expected profits in \(s''\) remain constant. This procedure can also yield an ex-ante Pareto improvement, which contradicts the optimality of the contract.

We therefore establish the following proposition.

**Proposition 1:** Even if the firm cannot commit themselves to any agreed-upon contracts, an optimal contract under symmetric information attains the efficient level of employment; that is, the firm employs the worker if and only if the output of the worker, \(s\), is greater than or equal to worker's disutility of effort, \(R\).

This proposition implies that no inefficient employment (i.e. underemployment or overemployment) occurs under symmetric information even though the firm cannot commit them-
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selves to any agreed-upon contracts. However, the recent literature has told us that reputation by itself will not enforce efficient behavior. For example, Klein and Leffler (1981), Shapiro (1982) (1983) and Allen (1984) show that reputational mechanisms are not sufficient to assure high quality supply in the product quality market. To see why the implication of Proposition 1 differs from that of the earlier literature, we must recognize that, in our model, moral hazard is not created by the decision whether to employ the worker but by the decision whether to default on the long-term contract. Our reputational mechanism assures the efficiency of employment under symmetric information because adjustments of wages and severance pay are enough to induce the firm to commit themselves to the long-term contract.

3. The Asymmetric Information Model

We now consider the case where output s is observed only by the firm alone. However, we assume throughout this section that everyone can observe whether the worker is employed in each period; that is, whether \( L(s) = 0 \) or 1.

Grossman and Hart (1981) (1983) and Hart (1983) discuss the properties of labor contracts under the asymmetric information model in which both the firm and the worker can commit themselves to an agreed-upon contract. Their main results are summarized as follows. (1) If the firm is risk neutral, an optimal contract is the first-best one: (i) The worker's income remains fixed in all states irrespective of his employment status, and (ii) the employment rule is efficient, or in other words, the worker is employed if and only if the output of the worker, \( s \), is greater than or equal to worker's disutility of effort, \( R \). (2) If the firm is risk averse, an optimal contract can involve underemployment: The worker is laid off for some of the states in which the output of the worker, \( s \), is greater than worker's disutility of effort, \( R \).

In what follows, to focus on the role of reputation in the contract market where the firm is not committed to any agreed-upon contracts, we will maintain the assumption that the firm is risk neutral. We can then prove in the later analysis that, as shown in the literature mentioned above, an optimal labor contract has neither underemployment nor overemployment if the first-best contract satisfies the reputational constraint.

Since the worker cannot observe output \( s \), contract arrangements cannot be constructed so as to depend on the true state. Instead, the firm is asked to report output \( s_r \) at the end of each period. Stationary long-term contracts are then specified as a function of \( s_r \); that is, wages \( w(s_r) \).

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7) Proposition 1 does not necessarily suggest that, irrespective of the presence of reputational problems, the contractual market is efficient under symmetric information. This is because noncommitment of the firm to agreed-upon contracts increases the possibility that contract relations are not made.

8) Another way of understanding the result of Proposition 1 can be stated as follows. In the symmetric information case, both the firm and the worker can observe states \( s \), so that the firm can make wages and severance pay contingent on the true state. The firm then finds it profitable to adjust wages and severance pay rather than employment possibility as long as the first-best contract satisfies reputational constraint (5). This is because the determination of wages and severance pay is soly concerned with the distribution of payoffs whereas the determination of employment possibility is mainly involved with the production of payoffs.

9) The "commitment" implies that an agent must always implement the contract arrangements if all agents can observe the variables on which the contract is contingent.
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severance pay \( y(s) \) and employment state \( L(s) \). Given this communication mechanism, an incentive-compatible contract \( [w(s), y(s), L(s); s \leq s \leq \bar{s}] \) is one such that the firm is always prepared to tell the truth namely (see Hart (1983))

\[
(9) \quad s = \arg\max_s \{L(s)[s - w(s)] - [1 - L(s)]y(s)\}.
\]

In general, the firm would have an incentive to lie: The firm would report output \( s \), which is not true. Fortunately, we can use the “revelation principle,” which restricts our attention to the set of truth telling contracts (see Harris and Townsend (1981) and Myerson (1979)). In other words, without loss of generality, we are allowed to confine our analysis to the set of contracts under which the firm always wishes to report the true state. We must therefore develop the properties of truth telling contracts in order to discuss how an optimal contract is arranged under asymmetric information.

We begin with examining the wage rule of truth telling contracts. For this purpose, let \( N = \{s | L(s) = 1\} \) (\( M = \{s | L(s) = 0\} \)) be the set of states in which the worker is employed (unemployed). The optimality for truth telling requires that \( w(s) \) equals a constant \( w \) on \( N \) and \( y(s) \) a constant \( y \) on \( M \). The reason can be explained as follows. If \( w(s') > w(s'') \) where \( s', s'' \in N \), the firm will pretend that \( s = s'' \) even when \( s = s' \). This is because, by doing so, the firm can reduce wages without sacrificing employment. Thus, \( w(s) \) has to be constant on \( N \) to ensure that truth telling is optimal. In a similar way, it can be proved that \( y(s) \) has to be constant on \( M \). Truth telling contracts in effect specify two wages: wages \( w \) on the set of employment states, \( N \), and severance pay \( y \) on the set of unemployment states, \( M \).

We next investigate the employment rule of truth telling contracts. Since the profits of the firm are \( s - w \) on \( N \) and \( -y \) on \( M \), the firm gains more profits from employing than from laying off the worker if \( s - w \geq -y \), and vice versa if \( s - w < -y \). Truth telling is thus optimal if and only if \( N = \{s | L(s) = 1\} = \{s | s - w \geq -y\} \) and \( M = \{s | L(s) = 0\} = \{s | s - w < -y\} \).

Let \( k = w - y \). The foregoing argument implies that truth telling contracts satisfy the following employment rule: \( N = \{s | s \geq k\} \) and \( M = \{s | s < k\} \).

Truth telling contracts are now characterized by two numbers: \( y \), severance pay the worker receives when unemployed, and \( k \), an extra amount the firm has to pay to employ him. From these two variables, wages the worker earns when employed are calculated using \( w = k + y \); and the employment rule is determined such that the firm employs the worker if and only if \( s \geq k \).

Given the properties of truth telling contracts, we can reformulate firm’s maximization problem (6). Since the firm’s profits are \( s - k - y(\equiv s - w) \) on \( N = \{s | s \geq k\} \) and \( -y \) on \( M = \{s | s < k\} \), the present value of stream of firm’s expected profits (6) is rewritten in the form

\[
(10) \quad E\pi = r^{-1} \left\{ \int_k^\bar{s} (s - k - y)f(s) \, ds - \int_k^\bar{s} yf(s) \, ds \right\}.
\]

Similarly, reservation utility constraint (3) under truth telling contracts is

\[
(11) \quad Ev = r^{-1} \left\{ \int_k^\bar{s} U(y + k - R)f(s) \, ds + \int_k^\bar{s} U(y)f(s) \, ds \right\} \geq \bar{V}.
\]

The final task is to reconsider reputational constraint (5). Under truth telling contracts, the constraint consists of the following two kinds of inequalities. If the firm employs the worker at the
end of the present period, i.e. if $s$ is greater than or equal to $k$, then

$$
(12) \quad s - k - y + r^{-1}(1 - r) \cdot \left\{ \int_{k}^{s} (s - k - y) f(s) \, ds - \int_{s}^{\hat{s}} y f(s) \, ds \right\} \geq 0,
$$

for $s \geq k$.

On the other hand, if the firm lays off the worker at the end of the present period, then

$$
(13) \quad -y + r^{-1}(1 - r) \cdot \left\{ \int_{k}^{s} (s - k - y) f(s) \, ds - \int_{s}^{\hat{s}} y f(s) \, ds \right\} \geq 0.
$$

In fact, constraint (12) automatically holds for all $s \geq k$ if constraint (13) is valid. Thus constraint (12) will be neglected in the subsequent analysis.

As shown in the previous section, reputational constraint (13) differs from the bankruptcy constraint of Farmer (1985) and Kahn and Scheinkman (1985). The main difference is that reputational constraint (13) contains the terms of future expected profits dependent on contract arrangements whereas their bankruptcy constraint does not. Furthermore, in our model, the worker is not indifferent between the employment and the laid off states, so that the possibility of involuntary unemployment can be accounted for.

Now, we can obtain an optimal contract by maximizing with respect to $k$ and $y$ the present value of stream of firm's expected profits (10) subject to reservation utility constraint (11) and reputational constraint (13). The first-order conditions for the maximization problem are represented by

$$
(14) \quad r^{-1} \cdot \left\{ -1 + \lambda [U'(y + k - R)(1 - F(k)) + U'(y)F(k)] - \mu \right\} = 0,
$$

$$
(15) \quad r^{-1} \cdot [1 - F(k)] + r^{-1} \cdot \lambda \cdot \left\{ U'(y + k - R)[1 - F(k)]
\right.
\left. + [-U(y + k - R) + U(y)]f(k) \right\} - r^{-1}(1 - r) \cdot \mu [1 - F(k)] = 0,
$$

where $\lambda$ and $\mu$ are the nonnegative multipliers associated with (11) and (13), respectively.

On the basis of (14) and (15), we can find out the properties of an optimal contract. The argument is divided into two parts according as the first-best contract summarized by $(k, y) = (R, U^{-1}(r \bar{V}))$ satisfies or violates reputational constraint (13).

If the first-best contract satisfies reputational constraint (13), we characterize the situation by substituting $k = R$ and $y = U^{-1}(r \bar{V})$ into the right-hand side of (13):

$$
(16) \quad r^{-1}(1 - r) \int_{R}^{\tilde{s}} sf(s) \, ds - r^{-1}(1 - r)\cdot [1 - F(R)] R - r^{-1}U^{-1}(r \bar{V}) \geq 0.
$$

In this case, the first-best contract, $(k, y) = (R, U^{-1}(r \bar{V}))$, violates neither (11) nor (13). Furthermore, it also satisfies first-order conditions (14) and (15) because the multiplier $\mu$ can equal zero in (14) and (15). Therefore, the first-best contract turns out to be an optimal solution to maximization problem (10).

Alternatively, if the first-best contract violates reputational constraint (13), we see

$$
(17) \quad r^{-1}(1 - r) \int_{R}^{\tilde{s}} sf(s) \, ds - r^{-1}(1 - r)\cdot [1 - F(R)] R - r^{-1}U^{-1}(r \bar{V}) < 0.
$$

10) The left-hand side of (13) does not depend on $s$. Thus, when discussing constraint (13), we need not consider which state occurs at the end of the period.

11) In the analysis that follows, we restrict our attention to the case that $s < k < \tilde{s}$. 

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This condition is likely to hold if worker's disutility of effort $R$ or reservation utility $V$ is great enough. Under condition (17), an optimal contract has to be a second-best contract because the first-best contract violates reputational constraint (13).

To examine the properties of an optimal contract in this case, we must transform (14) and (15). Rearranging (14) gives

$$\frac{1 + \mu}{\lambda} = U'(y + k - R)[1 - F(k)] + U'(y)F(k).$$

Subtracting (14) from (15) by side by side produces

$$-r^{-1}[1 + \mu - \lambda U'(y)]F(k) - \mu[1 - F(k)] = r^{-1}\lambda[U(y) - U(y + k - R)]f(k).$$

Now, using (18) and (19), we can prove that an optimal contract involves $k > R$ and $w - R > y$ if (17) holds. Suppose that $k \leq R$. Then it follows from $U' > 0$ and $U'' < 0$ that

$$U(y + k - R) \leq U(y),$$

$$U'(y + k - R) < U'(y).$$

Inspecting (18) with (21) and $\lambda \geq 0$ yields

$$1 + \mu - \lambda U'(y) \geq 0,$$

with strict inequality holding if $k < R$.

Given (22), it is found from (19) and $(\lambda, \mu) \geq 0$ that

$$U(y) - U(y + k - R) \leq 0,$$

where equality holds if and only if $k = R$. If $k$ is less than $R$, (23) is satisfied with strict inequality, thus contradicting (20). If $k$ is equal to $R$, the definition of $k (\equiv w - y)$ shows that $w - R = y$. This finding implies that the solution to (14) and (15) becomes the first-best contract, $(k, y) = (R, U^{-1}(r\bar{V}))$. Thus (23) again contradicts condition (17) when $k = R$. We therefore verify that $k > R$. It is also found from $k > R$ that the worker is better off on employment than on laid off states: $w = y + k > R + y$.

To sum up, we establish the following proposition.

**Proposition 2:** Assume that the firm is not committed to any agreed-upon contracts.

(i) If the first-best contract satisfies reputational constraint (13) (i.e. if inequality (16) holds), an optimal contract turns out to be the first-best contract: (a) The firm employs the worker if and only if the output of the worker, $s$, is greater than or equal to worker's disutility of effort, $R$; and (b) wages compensated with worker's disutility of effort, $w - R$, are equal to severance pay, $y$.

(ii) If the first-best contract violates reputational constraint (13) (i.e. if inequality (17) holds), an optimal contract can involve underemployment and involuntary unemployment: (a) The firm employs the worker if and only if $s \geq k (> R)$; and (b) wages compensated with worker's disutility of effort are higher than severance pay, i.e. $w - R > y$.

The idea behind the proof of Proposition 2 can be explained as follows. Proposition 2(ii) is based on the fact that the risk-neutral firm can bear all risks of variation of worker's income if the first-best contract satisfies reputational constraint (13). Worker's income then becomes constant irrespective of the level of employment. This fixed wage arrangement permits the risk neutral firm to choose the level of employment efficiently. In fact, with the assumption of Proposition

12) Let the left-hand side of (17) be $\Psi$. Partial differentiation of $\Psi$ with respect to $R$ and $\bar{V}$ reveals $\frac{\partial \Psi}{\partial R} < 0$ and $\frac{\partial \Psi}{\partial \bar{V}} < 0$. 
2(i), the statement of Proposition 2(i) is the counterpart of the result of Grossman and Hart (1981) (1983) because our model reduces to theirs.

To understand the intuition behind Proposition 2(ii), let us suppose that with the assumption of Proposition 2(ii) the firm offers the first-best contract to the worker. Since the first-best contract violates reputational constraint (13), the worker expects that the firm will default the first-best contract in unfavorable states, where unemployment occurs. Wages and severance pay are then adjusted so as to satisfy reputational constraint (13) in order that the worker might be attracted towards the contract relation. This adjustment causes wages compensated with worker’s disutility of effort, $w - R$, to become higher than severance pay, $y$; that is, $w - R > y$. Given the definition of $k \equiv w - y$, the obtained inequality relation implies $k > R$ and ensures the existence of the set of states, $\{s | k > s \geq R\}$. Now, for the set of states $\{s | k > s \geq R\}$, the firm strictly prefers layoff to retention because the incentive compatibility constraint induces the firm to lay off the worker if and only if $k > s$. The worker is unemployed for the set of states $\{s | k > s \geq R\}$ although he is employed in these states under the efficient rule of employment.

Proposition 2 shows that the reputational problem under asymmetric information between the firm and the worker is one of the important causes of underemployment if the firm is not committed to any agreed-upon contracts. This result still holds even if the firm has risk-neutral preferences so that underemployment does not arise from asymmetric information alone. Proposition 2 also implies that wages compensated with worker’s disutility of effort are higher than severance pay. In other words, under asymmetric information, the firm does not provide perfect income insurance to the worker if the firm cannot commit themselves to any agreed-upon contracts. This conclusion explains why complete severance pay is infrequently observed in the real world (see Oswald (1986)). Furthermore, unemployment realized in this case is involuntary because the worker prefers being employed to being laid off. Our theory therefore generates equilibria in which there are both inefficiently high unemployment (underemployment) and involuntary unemployment.

4. Concluding Remarks

This paper has examined a role of reputation in an implicit contract model where firms cannot commit themselves to the contract arrangements. In contrast to the recent literature on reputation, we have shown that an optimal contract under symmetric information enforces efficient behavior on firms irrespective of the presence of reputational problems. On the other hand, even though firms are risk neutral, we have proved that an optimal contract under asymmetric information can involve inefficiently high unemployment (underemployment) and involuntary unemployment in the presence of reputational problems. We have also shed light the question why laid off workers cannot receive full amount of severance pay.

There are several other promising extensions of our analysis that may pursue. First, we have restricted our attention to the environment where the firm has only one worker. Applying the analysis to a model of many workers enables us to deal with more complicated employment policies of firms. Second, our investigation has been limited to stationary long-term contracts. Relaxation of this assumption seems to be crucial if contracting parties have incomplete information about the attributes of the opponent parties. In the incomplete information case, the con-
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tracting parties must hold some expectations about the attributes of the opponents. These expectations depend on the past actions of the opponents and affect current and future equilibrium actions. This kind of dynamic equilibrium situation has recently been developed using the sequential equilibrium method (For example, see Osano (1989)). It seems to be important to discuss the properties of non-stationary long-term implicit contracts within the sequential equilibrium framework.

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