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"LAYOFFS AND UNEMPLOYMENT COMPENSATION AS SOCIAL INSTRUMENTS"

by

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1. Introduction

Markets do not exist for the direct exchange of claims for future labor services given the obvious problems of moral hazard. Recent developments in the theory of implicit contracts[1] suggest that at least part of the risk can be transferred to the capital markets through the institution of an employing firm which is assumed to be less risk averse than the workers. The firm, with its readier access to credit finds it profitable to compete for labor not merely in terms of the current wage but also in terms of employment security and future wage guarantees. The properties of models which attempt to capture some of the insurance features present in such an environment are well known by now. In the extreme case of a risk neutral firm with risk-averse employees, the optimal employment contract insures the workers fully with the wage being set independently of the state of nature while employment tends to fluctuate given the state of product demand, productivity and other relevant variables.[2] Fluctuations in employment may take the form of changes in hours worked or, if indivisibilities and nonconvexities are present, in the form of reducing the number of workers in a firm.

The striking simplicity of this result suggested immediately the possibility of explaining the normal industrial practice of laying off part of the work force and paying unchanged wages to the rest of the work force as an essential part of the insurance agreement. Several problems prevent the over hasty acceptance of the proposition that implicit contract theory as developed thus far provides a complete explanation of the phenomenon of layoffs. The standard implicit contract model, as exemplified by Azariadis (1975), suggests that all workers be insured. Thus, even those who are laid off will be paid the wage paid to the employed workers. To put it somewhat differently, implicit contract theory fails to explain incomplete severance.

The commonly observed schemes for unemployment compensation (which may be viewed as akin to severance pay) involve payment by the firm to the state or a central authority as taxes and direct compensation by the center to adversely affected workers. If firms are risk-neutral it makes little difference whether firms pay the compensation directly to workers or whether workers collect it from the state. The possibility of bankruptcy clearly provides an incentive for the state to undertake that responsibility. Against this must be weighed the many problems of moral hazard that arise when such compensation becomes an "external benefit" providing the firm with incentives to lay-off "too many" workers under adverse conditions.

The third argument against the claims of contract theory lies in its ability to explain "involuntary unemployment". It is far from clear that any of the observed levels of unemployment are "involuntary" and it is even less obvious how one might determine if this were the case. For my purposes, I will define involuntary unemployment as any situation where there exist gains to trade in labor services so that both buyer and seller stand to gain from increased employment. It is almost axiomatic in standard competitive theory that such an allocation cannot be an equilibrium. Attempts have therefore been made within the confines of "disequilibrium theory" motivated by the firm conviction that "what looks like involuntary unemployement is involuntary unemployment" (Solow (1980)). The view taken here is that it is possible to rationalize involuntary unemployment as part of an optimal contract. It is not my intention in this paper to study the cyclical aspects of unemployment.[3] It is rather to develop an extremely simple, somewhat artificial model, that is capable of generating involuntary unemployment in the sense mentioned above. The pure risk sharing labor contract model cannot explain involuntary unemployment as defined here. If there are gains to trade then they will be exercised.

Recent developments in the theory of contracts with asymmetric information (Myerson (1979), Harris and Townsend (1980), Prescott and Townsend (1980)) lead to the conclusion that when agents possess different information sets, the resulting equilibrium allocation may well involve ex-post gains to trade. This insight has been utilized by labor contract theorists (Grossman and Hart (1980), Green (1980), Chari (1980)) to develop models that explain wage rigidity and yield underemployment equilibria. All these authors endow the firm with superior information about the state of nature. The resulting allocation may, under some circumstances, involve ex-post gains to trade. These models, however, yield the same result as the more traditional contract models in that they continue to predict that <u>all</u> workers, both employed and unemployed will receive the same wage in any given state of nature.[4] In this sense, these models cannot explain why laid off workers should be any more distressed than those currently employed. In fact, if there is any disutility attached to work, then unemployed workers may have a higher level of utility than their working brethren.

A simple model is developed in section 2 to counter some of the criticisms sketched out above. The essence of the model is a different view of the firm than the one commonly used in the literature. A firm is viewed as a group of individuals who have access to a common technology which is subject to random shocks.[5] It is assumed that there are a large number of such firms in the economy and that the firms share the risk inherent in the production technology. The key assumption is that only the workers within a firm know the realization of the productivity shock. All that is observed by other firms is the fraction of individuals working in any given firm. The output of a firm is not observable. In such an environment, the only incentive compatible contracts are those that create lotteries or randomization. It is natural to view these randomized allocations as reflecting layoffs. A logical consequence is that those who get a poor draw when the allocations are randomized are involuntarily unemployed in the sense that they receive less from unemployment compensation than the wages paid their more fortunate colleagues while being different in no discernible way. Furthermore, they are willing to work at less than is paid to those currently employed and the marginal rate of substitution between leisure and consumption is less than the marginal rate of transformation. Consequently, there are self-evident gains to trade. It also turns out that the unemployment compensation <u>cannot</u> be paid by the firms directly. Such a scheme would induce risk sharing among the workers, thereby vitiating the intent of the randomized allocations which is to induce truthful revelation of the state of nature.

Section 3 extends the basic model discussed in section 2 to an environment where the number of hours worked is observed as well as the fraction of workers in the labor force who are employed. Section 4 concludes the paper.

2. A Model of Layoffs

The economy is characterized by a large number of identical workers who have access to a constant return to scale technology for producing a single consumption good. The output produced by a worker in n hours is given by

$$x = \theta_i n \tag{2.1}$$

Where θ_i is a productivity shock. For simplicity, we will assume that θ can take on one of two values only and

$$0 < \theta_1 < \theta_2. \tag{2.2}$$

This assumption is not crucial to what follows and the results can be extended to the case when θ can take on a larger finite set of values.

The productivity shock is drawn from the set $\{\theta_1, \theta_2\}$ with probabilities λ_1 and λ_2 respectively. One interpretation is that the fraction of all workers who receive a productivity shock θ_i is λ_i.

Workers have preferences only over the consumption good which are described by a utility function[6]

$$\begin{aligned} &U(c) \quad \text{increasing, bounded, twice differentiable, strictly concave.} \\ &U: \mathbb{R}^+ \to \mathbb{R} \\ &0 \leq n \leq 1. \end{aligned}$$

The informational structure of the economy is that workers cannot observe each other's productivity draws and furthermore cannot observe output. All that is observable is whether another worker is working or not i.e. it is known whether $n_j = 0$ or $n_j > 0$ where j indexes a worker. This assumption is crucial as is seen in the next section.

Prior to the realization of the productivity shock, there is a clear incentive to set up a risk sharing scheme. To explore this notion further, consider the allocations that result under full information. Clearly $n = 1$. Let y denote the transfer received by a worker. Thus, if c_i is the consumption level of a worker who has drawn a productivity shock θ_i, then

$$c_i = \theta_i + y_i \tag{2.3}$$

it is clear that with no asymmetry in information

$$c_1 = c_2 \tag{2.4}$$

and

$$\lambda_1 y_1 + \lambda_2 y_2 = 0 \tag{2.5}$$

Equation (2.4) is the resource constraint. For mathematical convenience, the choice of the transfer set is restricted to be compact[7]

$$y \in [-K, K] \tag{2.6}$$

where

$$K \gg \theta_2.$$

It should be clear that the full information allocation is not incentive compatible. Workers with draws of high θ would pretend to have received a low θ draw in order to receive a transfer and thereby increase their consumption levels. Any incentive compatible deterministic mechanism can be easily dominated by a random allocation except possibly for autarky i.e. $y_1 = y_2 = 0$. In effect, such a mechanism requires each worker to report a value of θ. A wheel is then spun and contingent upon the outcome of this random process, the worker is either instructed not to work and receives a certain transfer or is instructed to work for possibly a different transfer. Such deliberate randomization may yield higher <u>average</u> utility than autarky, yet ensure that the worker has an incentive to reveal the true value of θ. (For numerous examples and detailed investigation of such schemes, see Myerson (1979), Prescott and Townsend (1980)). The following notation will be useful in further investigation:

y_{ij}: Transfer from the center if the agent reports θ_i and the wheel after being spun reads $j = 1,2$.

q_{ij}: Probability of receiving y_{ij}.

$$c_{i1} = y_{i1} \quad \text{:Consumption in state i if } j = 1 \tag{2.7}$$

$$c_{i2} = \theta_i + y_{i2} \quad \text{:Consumption in state i if } j = 2 \tag{2.8}$$

$$i = 1,2$$

Thus, j=1 is identified as the "no work" and j=2 is identified as the "work" instruction respectively. Recall that all that is observed is whether the worker works or not. An optimal incentive compatible mechanism is a set

$$\{y_{ij}, q_{ij}\}$$
$$y \in [-K, K]$$
$$0 \leqslant q_{ij}$$
$$\sum_j q_{ij} = 1 \qquad i=1,2;\ j=1,2.$$

which solves the following programming problem

$$\text{Max} \sum_i \lambda_i \sum_j q_{ij} U(c_{ij}) \tag{2.9}$$

$$\text{s.t} \quad \sum_i \lambda_i \sum_j q_{ij} y_{ij} \leqslant 0 \tag{2.10}$$

$$\text{and} \quad \sum_j q_{1j} U(c_{1j}) \geqslant q_{21} U(y_{21}) + q_{22} U(\theta_1 + y_{22}) \tag{2.11}$$

$$\sum_j q_{2j}U(c_{2j}) \geq q_{11}U(y_{11}) + q_{12}U(\theta_2 + y_{12}) \tag{2.12}$$

and equations (2.7) and (2.8).

The usual non-negativity conditions also apply. Equations (2.11) and (2.12) are the incentive compatibility constraints. The expected utility of the worker must be at least as high when he reports the truth as when he lies. Equation (2.10) is the economy-wide resource constraint.

Several results follow immediately from the incentive compatibility constraints and the resource constraint.

Result 1: $q_{21}y_{21} + q_{22}y_{22} \leq 0$.

Quite obviously, there must be transfers from the high state θ_2 to the low state θ_1, (Recall that the first subscript refers to the state).

Proof: Suppose not. Then, from equation (2.10) $q_{11}y_{11} + q_{12}y_{12} \leq 0$ Then, $U(\theta_1) \geq U(\theta_1 + q_{11}y_{11} + q_{12}y_{12}) > q_{11}U(y_{11}) + q_{12}U(\theta_1 + y_{12})$ by strict concavity of U. Now, consider the difference in utilities between the autarky allocation and the given allocation.

$$\begin{aligned}
&\lambda_1[U(\theta_1) - q_{11}U(y_{11}) - (1-q_{11})U(\theta_1 + y_{12})] \\
&\quad + \lambda_2[U(\theta_2) - q_{21}U(y_{21}) - (1-q_{21})U(\theta_2 + y_{22})] \\
&\quad > \lambda_1[U(\theta_1) - U(\theta_1 + q_{11}y_{11} + (1-q_{11})y_{12})] \\
&\quad + \lambda_2[U(\theta_2) - U(\theta_2 + q_{21}y_{21} + (1-q_{21})y_{22})] \\
&\quad > \lambda_1 U'(\theta_1)[q_{11}y_{11} + (1-q_{11})y_{12}] \\
&\quad + \lambda_2 U'(\theta_2)[q_{21}y_{21} + (1-q_{21})y_{22}] \\
&\quad > 0
\end{aligned}$$

The last inequality follows from the fact that $\theta_1 > \theta_2$ and the resource constraint (2.10).

Result 2: If $0 < q_{ij} < 1$ for all i,j then both incentive compatibility constraints must be binding.

Proof: Without loss of generality, let (2.12) alone be binding and

$$y_{21} > \theta_2 + y_{22}$$

Then, there exists $\varepsilon > 0$, such that by reducing y_{21} by ε/q_{21} and increasing y_{22} by ε/q_{22}, utility is increased without any of the constraints being violated.

The same logic applies if $y_{21} < \theta_2 + y_{22}$.

Proposition 1: Randomization can occur only in the low state i.e. θ_1.

Proof: Suppose that state θ_2 has random allocations. Then, consider the following set of inequalities.

$$\begin{aligned} & q_{21}U(y_{21}) + (1-q_{21})U(\theta_1 + y_{22}) \\ & \quad < q_{21}U(\theta_1 + y_{21}) + (1-q_{21})U(\theta_1 + y_{22}) \\ & \quad < U\left(\theta_1 + q_{21}y_{21} + (1-q_{21})y_{22}\right) \\ & \quad \leqslant U(\theta_1) \end{aligned} \tag{2.13}$$

The last inequality follows from Result 1. But note that equation (2.13) is the right side of (2.11) which must be binding. Then $q_{11}U(y_{11}) + q_{12}U(\theta_1 + y_{12}) < U(\theta_1)$ Similarly, expected utility in state 2 is worse than under autarky. Thus, this allocation cannot be optimal. Q.E.D.

The programming problem can now be rewritten as follows

$$\text{Max } \lambda_1\left[qU(y_1) + (1-q)U(\theta_1 + y_2)\right]. \tag{2.14}$$

$$+ \lambda_2 U\left(\theta_2 - \frac{\lambda_1}{\lambda_2}(qy_1 + (1-q)y_2)\right)$$

$$\text{s.t} \qquad U\left(\theta_2 - \frac{\lambda_1}{\lambda_2}(qy_1 + (1-q)y_2)\right) \geqslant qU(y_1) + (1-q)U(\theta_2 + y_2) \tag{2.15}$$

It will be noted that an incentive compatibility constraint has been dropped. It would have read

$$qU(y_1) + (1-q)U(\theta_1 + y_2) \geqslant U\left(\theta_1 - \frac{\lambda_1}{\lambda_2}(qy_1 + (1-q)y_2)\right)$$

The left side of this equation is clearly greater than $U(\theta_1)$: utility under autarky, since $U(c_2) \leqslant U(\theta_2)$. Thus, this constraint is always satisfied.

The first order conditions for this problem[8] are

$$(\lambda_1 - \gamma)q\, U'(y_1) - (1 + \gamma)\,\lambda_1 q\, U'(c_2) \leqslant 0 \tag{2.16}$$

$$\text{with equality if } y_1 > 0$$

$$\lambda_1(1-q)\, U'\,(\theta_1 + y_2) - \gamma(1-q)\, U'(\theta_2 + y_2)$$

$$- (1 + \gamma)\,\lambda_1(1-q)\, U'\,(c_2) \leqslant 0 \tag{2.17}$$

$$\text{with equality if } \theta_1 + y_2 > 0$$

$$c_2 = \theta_2 - \frac{\lambda_1}{\lambda_2}\left[qy_1 + (1-q)\, y_2\right] \tag{2.18}$$

$$\lambda_1\left[U(y_1) - U(\theta_1 + y_2)\right] - \gamma\left[U(y_1) - U(\theta_2 + y_2)\right] \tag{2.19}$$

$$- (1 + \gamma)\, U\,(c_2) \qquad \begin{cases} \leqslant 0 \text{ if } q = 0 \\ = \text{ if } 0 < q < 1 \\ \geqslant \text{ if } q = 1 \end{cases}$$

$$U(c_2) = q\ U(y_1) + (1-q)\ U\ (\theta_2 + y_2) \tag{2.20}$$

Simple manipulation of (2.16) and (2.17) yields, if $0 < q < 1$ and $y_1 > 0$,

$$(\lambda_1 - \gamma)\ U'(y_1) = \lambda_1\ U'(\theta_1 + y_2) - \gamma\ U'(\theta_2 + y_2) \tag{2.21}$$

Note that $\theta_2 + y_2 > \theta_1 + y_2$ Equation (2.21) then implies

$$(\lambda_1 - \gamma)\ U'(y_1) > (\lambda_1 - \gamma)\ U'(\theta_1 + y_2) \tag{2.22}$$

From equation (2.16), we have $\lambda_1 > \gamma$. Thus, $y_1 < \theta_1 + y_2$.

We have thus proved that if the equilibrium allocation is different from that under autarky, and consumption in the poor state is positive, then there exists involuntary unemployment in the sense that the unemployment compensation received by a fraction of the work force is less than the wages paid the remainder of the work force in the low productivity industry.

Formally, define involuntary unemployment to occur when

(a) $y_1 < \theta_1 + y_2$

(b) $0 < q < 1$.

It is clear that (b) implies (a). Thus, whenever there is a random allocation in this environment, we have involuntary unemployment.

Result 3: If $q = 0$, then $y_1 = y_2 = 0$. i.e. we have autarky.

Proof: Follows from equation (2.20).

Before proceeding to establish any further results, it is worthwhile to repeat the essential point of the preceding analysis. It is certainly plausible to interpret a group of workers all of whom receive a productivity shock θ as belonging to a firm. Transfers in this context are best interpreted as borrowing from the capital market or paying out dividends. In essence, the problem is to convince the capital markets that a firm which has drawn a low productivity shock is in a genuinely bad way.[9] The only mechanism that will convince the markets is, in effect, one that involves laying off part of the work force <u>without</u> full severance pay. This permits the firm to receive transfers, or on this interpretation, to be able to borrow. It is critical that the firm not pay laid off workers directly. Suppose indeed that the firm received the entire expected transfer $qy_1 + (1-q)y_2$ and could distribute it to the workers. Note that neither the consumption levels of the workers nor the output of the firm is observable. It is clear that in this environment, the optimal arrangement is to share total consumption equally. But this cannot be incentive compatible. In effect, the worker must be separated from his colleagues and receive his pay check at the unemployment office. The device of ensuring that the wage rate is not observed by the center is not unreasonable if one allows for leisure on the job as part of the wage rate.

In a sense, what we have here is a substantially different concept of the firm from that commonly used in the literature. A firm is identified as a group of workers who share access to a common technology (in the sense of receiving a common productivity shock) and share risk among themselves. Furthermore, the internal activities of the firm (labor supply) are not observable to outsiders. There is imperfect mobility in that ex-post migration to other firms is prohibitively costly. The key element is that risk sharing is feasible <u>among</u> firms subject to informatiional constraints. After the realization of the productivity shock, a randomly chosen number of workers are separated from the firm in the sense that institutional arrangements are set up to prevent them from sharing risk with those remaining in the firm. Such arrangements may involve the payment of unemployment compensation by the government and layoffs rather than reductions in the work week. Those "laid off" would rather be working while the remainder working within the firm recognize that rehiring the laid off workers even at their opportunity wage (i.e., y_{11}) jeopardizes their ability to "borrow from the capital market" (i.e., other firms) since such action is taken as indicative of a lack of serious attention toward "cost-cutting" even though such rehires are productively efficient. Those employed in the most productive firms (the θ_2 type) must pay in taxes and dividends the cost of insuring the low productivity firms.

In this model, the role of the government which presumably pays unemployment compensation through tax levies and the role of the capital market (in the form of dividends paid out and borrowing done from other firms) are not separated. This can be easily done. The effect of taxes to pay laid off workers is internalized by altering the transfers between firms.

3. Optimal Allocations With Observable Labor Supply

This section modifies the model considered in section 2 and allows the center to observe the number of hours worked by a worker. This additional instrument can be utilized by the center to alter consumption levels and thereby reward truthful revelation. The main result is that while involuntary underemployment always results in the sense that workers in low productivity industries find themselves working fewer hours than they desire or is technologically feasible, there are no layoffs. In other words, there is work sharing. The key reason is that with control over labor supply decisions, consumption levels can be altered without disturbing transfers.

The technology and preferences of workers are the same as in Section 2.

Again, we restrict ourselves to an analysis where there are only two states of nature. Results similar to those obtained in section 2 apply in this case as well. If there is any randomness in the allocations, then it must be in the low state, θ_1. We will restrict our analysis to a situation where there are only two sets of labor supply and transfer over which there is randomness in the low state though, as is seen below, this is not a serious restriction. It is also clear that since there is no disutility attached to labor supply, n is equal to 1 in state θ_2.

An optimal mechanism in view of the foregoing is

(a) A probability $0 \leq q \leq 1$

(b) Labor supply n_{11} with probability q in state θ_1 n_{12} with probability (1-q) in state θ_2

(c) Respective transfers y_{11}

y_{12}

and a transfer when the state is θ_2

y_2

which solves

$$\text{Max } \lambda_1 \{q\ U(\theta_1 n_{11} + y_{11}) + (1-q)\ U\ (\theta_1 n_{12} + y_{12})\} + \lambda_2\ \{U\ (\theta_2 + y_2)\} \tag{3.1}$$

$$\text{s.t.} \quad \lambda_1 (q y_{11} + (1-q) y_{12}) + \lambda_2 y_2 \leq 0 \tag{3.2}$$

$$\text{and} \quad qU(\theta_1 n_{11} + y_{11}) + (1-q)\ U\ (\theta_1 n_{12} + y_{12}) \geq U(\theta_1 - y_2) \tag{3.3}$$

$$U(\theta_2 - y_2) \geq qU(\theta_2 n_{11} + y_{11}) + (1-q)\ U(\theta_2 n_{12} + y_{12}) \tag{3.4}$$

The following lemma is a useful first step in establishing the result that there are no layoffs.

Lemma: $\theta_1 n_{11} + y_{11} = \theta_1 n_{12} + y_{12}$

Proof: The obvious reason for this result is the possibility of risk sharing. Without loss of generality, suppose

$$\theta_1 n_{11} + y_{11} > \theta_1 n_{12} + y_{12}$$

We can now reduce n_{11} by $\varepsilon/\theta_2 q$, increase y_{11} by ε/q, reduce n_{12} by $\varepsilon/\theta_2(1 - q)$, increase y_{12} by $\varepsilon/(1 - q)$. The incentive compatibility constraints are not violated and utility is increased. A similar argument goes through even if $n_{11} = 0$.

Equation (3.3) is irrelevant by an argument similar to that in section 2. We now consider the first order conditions of this problem for the variables y_{11} and y_{12}. Let c_2 denote consumption in state 2 and γ the Lagrange multiplier associated with equation (3.4). After substituting in the resource constraint, we get the following conditions when $0 < q < 1$.

$$\lambda_1 U'(\theta_1 n_{11} + y_{11}) - \gamma U'(\theta_2 n_{11} + y_{11}) - (1-\gamma)\lambda_1 U'(c_2) = 0 \tag{3.5}$$

$$\lambda_1 U'(\theta_1 n_{12} + y_{12}) - \gamma U'(\theta_2 n_{12} + y_{12}) - (1+\gamma)\, \lambda_1 U'(c_2) = 0 \tag{3.6}$$

It is apparent from this that

$$\theta_2 n_{11} + y_{11} = \theta_2 n_{12} + y_{12} \tag{3.7}$$

Equation (3.7) and the lemma establish

Theorem 1: $n_{11} = n_{12}$; $y_{11} = y_{12}$ and there is no difference in the random allocations in the low state.

Consequently, though labor supply in the low state is less than its feasible maximum there are no layoffs. This structure can explain the involuntary nature of unemployment but not the existence of layoffs or incomplete severance or the existence of centrally administered unemployment compensation schemes.

Theorem 1 continues to hold if the worker derives disutility from labor supply and the utility function is separable in consumption and labor supply.

4. Conclusion

Extant models of labor contracts generate layoffs consistent with observed patterns through a simple zero-one choice variable regarding employment. They generate involuntary unemployment through the simple device of endowing the firm with superior information thereby ensuring that the resulting allocations will not be optimal ex-post. In the absence of nonconvexities such unemployment generally takes the form of work-sharing. In other words, while the wage may vary with the state of nature and the number of hours worked, the number employed is the same. With nonconvexities in labor supply, while layoffs may occur, the wage paid is the same whether or not one works, though it varies with the state of nature.

A simple model has been presented here with no nonconvexities in labor supply decisions which yields layoffs and involuntary unemployment. Such nonconvexities as there are, lie in the monitoring technology where the number of hours worked is not observed. A casual observer of the economy developed in section 2 would certainly describe the unemployment there as involuntary. Workers are unemployed who would cheerfully work for even less than their seemingly identical fellow men are earning. Wage rates do not adjust to this "excess supply". There are no obvious technological barriers that would prevent the employment of these workers. Firms apparently ration by quantity rather than price.

Prescott and Townsend (1980) have proposed an ingenious competitive mechanism for economies similar to that described in this paper. Their contention is that lotteries could be sold competitively which promise to pay contingent both on reported states of nature and a random draw. It remains an open question why we do not observe such competitive lotteries. The obvious problems of moral hazard (who is to verify the random draw?) and the problems of adverse selection in such an insurance market may pose an answer. In lieu of such a device, we have postulated an optimal allocation which is implementable rather than a competitively determined mechanism.

The contrast between the results of the models in sections 2 and 3 may lie partly in the elimination of the nonconvex monitoring technology. I conjecture, though, that part of the reason lies in the fact that the center has two instruments; transfers and labor supply, to manipulate a single target variable; consumption. With separate shocks to the firm as a whole and to individual labor supply by the worker, layoffs may yet be a useful tool to achieve optimal allocations. An obvious extension of this work would be to allow for work week changes as well as employment fluctuations.

In contrast to traditional models, which identify the interests of the firm with those of the capital market against the interests of the workers, this paper has identified the firm's interests as the interests of the workers. This view is illuminating in that the role of the capital market in sharing risk is made explicit. Further extensions of this line of thought to include a market for managers would, I conjecture, result in models that explain incentive plans and bonuses for managers while workers would have to bear even less risk.

NOTES

[1]The original work is due to Azariadis (1975), Baily (1974) and Gordon (1974). Azariadis (1979) contains an excellent survey of this work.

[2]This is true only for the special case when the utility function is separable in consumption and leisure. More generally, insurance implies equalization of the marginal utilities of consumption across states.

[3]Discussion of unemployment has been conducted almost exclusively within a macroeconomic framework until very recently. There is very little justification for the notion that contract theory explains cyclical unemployment. Firms and capital market are almost certainly not risk neutral with respect to movements in economy wide aggregates. There is even less justification to suppose that labor contract models rationalize nominal wage rigidity.

[4]More precisely, the marginal utilities of consumption will be equated for both types of workers. This holds, regardless of whether firms are risk-averse or not.

[5]Firms in this model may be thought of as "labor managed" and hiring capital. This device serves two purposes. It makes explicit an environment where all risks are diversifiable, yet the existence of asymmetric information ensures that firms and the capital market are not risk-neutral. Risk aversion in the capital markets is seen to be directly tied in with the nature of asymmetries in information.

[6]This is not restrictive at all. As is evident from the rest of the analysis, if the preferences were described by a utility function over consumption and labor supply and both are normal goods, the same conclusions follow.

[7]K must be chosen to be sufficiently large. It may be in some circumstances that there may be a Pareto-superior allocation with a larger transfer. It is not clear how this difficulty can be overcome.

[8]There is a potential problem with convexity of the constraints. The objective function is not concave as well. The following propositions can be proved in a more roundabout fashion. Essentially the procedure is to resstrict consideration to a finite transfer set and then use limiting arguments. See Prescott and Townsend (1980) for details.

[9] Actually, the problem is to prevent <u>all</u> firms from reporting that they are distressed. Firms with high θ's must be discouraged from pretending to have drawn low θ's.

REFERENCES

1. Azariadis, C. (1975), "Implicit Contracts and Underemployment Equilibria," Journal of Political Economy 83, December, pp. 1183-1202.

2. Azariadis, C. (1979), "Implicit Contracts and Related Topics: A Survey," Department of Economics, University of Pennsylvania, November.

3. Chari, V.V. (1980), "Involuntary Unemployment and Implicit Contracts," Center for Mathematical Studies in Economics and Management Science, Discussion Paper No. 459, Northwestern University.

4. Baily, M.N. (1974), "Wages and Unemployment Under Uncertain Demand," Review of Economic Studies 41, January, pp. 37-50.

5. Gordon, D.F. (1974), "A Neoclassical Theory of Keynesian Unemployment," Economic Inquiry 12, December, pp. 431-459.

6. Harris, M. and R. Townsend (1977), "Resource Allocation Under Asymmetric Information," Carnegie-Mellon University working paper.

7. Holmstrom, B. (1979), "Equilibrium Long Term Labor Contracts," Northwestern University discussion paper No. 414.

8. Myerson, R. (1979), "Incentive Compatibility and the Bargaining Problem," Econometrica 47, January, pp. 61-74.

9. Prescott, E.C. and R.M. Townsend (1980) "On Competitive Theory with Private Information" Carnegie-Mellon University working paper.

10. Solow, R. (1980), "On Theories of Unemployment," American Economic Review 70, March, pp. 1-11.