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Endogenous Adverse Selection and Unemployment Insurance

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In this paper we consider how the presence of private information may explain the failure of the private sector to provide unemployment insurance. In particular, we show how the interaction of private information regarding employees' preferences for work with the unobservable level of effort exerted on the job may explain the absence of private unemployment insurance. We also reflect on the implications of our findings for the role of the public sector in providing unemployment insurance.

I. Introduction

Unemployment insurance is unique in that unlike other forms of insurance it has never been provided by the private sector.\textsuperscript{1} It may

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\textsuperscript{1} At one time (about 1926) the Metropolitan Life Insurance Co. considered underwriting unemployment insurance and sponsored a bill, which passed the New York legislature, to make such insurance legal (see Becker 1965). In Canada an unemployment insurance plan for executives called Career Guard was introduced in the 1982–83 recession (see Sec. IVB below). In some countries (e.g., Sweden, Finland, and Denmark) and some sectors of the U.S. economy, some unemployment insurance is provided by unions. In the United States in the late nineteenth and early twentieth centuries, some community programs assisted unemployed workers. Such programs were never widespread, however (see Nelson 1969). Currently, unemployment insur-
be argued that the provision of unemployment insurance by the government effectively crowds out private unemployment insurance. However, the fact that private unemployment insurance was not offered before unemployment insurance by the public sector was introduced suggests that other, more fundamental, reasons explain the universal absence of private unemployment insurance. In this paper we present a model of a competitive unemployment insurance market within which we examine conditions that imply the existence of equilibrium in which no unemployment insurance is provided. We use the results to assess some common features of public unemployment insurance programs.

Unemployment insurance is intended to insure employees against income loss associated with being laid off because of unsatisfactory job performance, adjustments in employment required to improve the operation of the firm, or changing market conditions. It is not intended to insure employees against income loss caused by voluntarily quitting a job or being fired for misconduct. The latter causes of unemployment represent uninsurable risks since the outcome is subject to manipulation by the insured. In practice the distinction between misconduct and incompetence is often not clear-cut, and job performance is subject to manipulation by employees.

The literature on insurance economics suggests that the presence of private information or aggregate risk may hinder the provision of insurance by the private sector. The existence of private information or aggregate risk does not generally result in the absence of private insurance, however, and the special nature of unemployment risk that makes it susceptible to an extreme form of failure on these counts must therefore be understood before such explanations can be accepted. The main objective of this paper is to examine the effect of private information on unemployment insurance. We comment on the issue of aggregate risk in Section IV.

Employees eligible for unemployment insurance possess private information—namely, their preference for leisure—that gives rise to adverse selection not found in other insurance markets. More specifically, in the course of their lifetimes some individuals are likely to experience changing attitudes toward work. When a child

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ance in the United States is administered by the federal government and state employment security agencies and is funded by a federal unemployment tax levied on the taxable payroll of most employers. Some private supplementary unemployment benefits are provided by unions and employers, especially in the manufacturing sector (see Oswald 1986). Union-based unemployment insurance is generally an outcome of collective bargaining and, being nonvoluntary, is similar to the public unemployment insurance discussed below.
is born, for example, one of the parents may prefer to take time off from work to stay home with the child. In another example, a worker decides to take time off to go back to school. Thus unemployment, which is considered to be “bad” for most employees, is considered to be “good” by some. This source of private information is a focal point of the analysis that follows.

Two types of hidden actions give rise to moral hazard in unemployment insurance. First, the prospect of finding new employment by a laid-off worker—and consequently the cost to the insurer—is determined to a large extent by the effort the unemployed worker exerts in searching for new employment. This effort constitutes a hidden action since “an insurance company or a government may have great difficulty distinguishing a person who cannot find a suitable job from a person who isn’t trying to find a suitable job or at least not trying very hard” (Diamond 1993, p. 8). Second, employees’ efforts on the job affect their job performance and thus the probability of their being laid off.

The key idea pursued below is that interaction between the employees’ tastes for leisure and the efforts they exert performing their jobs gives rise to a type of adverse selection that may entail the existence of a unique competitive equilibrium in which no unemployment insurance is provided, even though the agents are risk averse. For lack of established terminology we refer to this type of adverse selection by the name endogenous adverse selection. The moral hazard problem that arises as a result of the nonobservability of efforts exerted while searching for new employment by workers who were laid off tends to exacerbate the effect of endogenous adverse selection, thereby making the equilibrium with no unemployment insurance more likely. Unlike the moral hazard associated with efforts exerted in discharging one’s duties while employed, however, the moral hazard associated with job search in itself does not explain the existence of the “no unemployment insurance” equilibrium.

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2 If preferences were random but observable, there might still be room for unemployment insurance, although the analysis in this case would not differ substantially from that of optimal risk-sharing contracts (see Rosen 1985).
3 The adverse effect of unemployment insurance on job search and consequently on unemployment has been long recognized (see Topel and Welch [1980] for a survey and references).
4 This type of hidden action is the focal point of the analysis of equilibrium unemployment in Shapiro and Stiglitz (1984). For further discussion of this point, see Sec. IVC.
5 The joint presence of moral hazard and adverse selection in insurance is of analytical interest in its own right and may give rise to new types of competitive equilibria. For a recent analysis, see Chassagnon and Chiappori (1995).
II. The Model

A. The Unemployment Risk

Consider a competitive economy in which the continuing reallocation of the labor force in response to shifting market conditions results in a certain level of unemployment. For simplicity, assume that labor force participants are either employed full-time at the competitive wage rate or unemployed. At the outset of each period there is a labor market in which unemployed workers search for jobs. Each period, after the closing of the labor market, every individual receives private information regarding his or her preferences for leisure one period hence. To simplify the analysis we assume that the working population consists of two types of individuals: individuals with normal preferences for leisure and individuals with strong preferences for leisure one period hence. Given his preference type, each eligible individual chooses an unemployment insurance policy for the subsequent period. To weed out individuals who do not participate in the labor force, we assume that an individual must be employed during the current period to qualify for unemployment insurance for the subsequent period.

The insurance industry is assumed to be competitive and the distribution of preference types in the population stationary. Insurers are informed about the distribution of employees according to their preference type (i.e., letting $\lambda$ denote the proportion of employees with a normal preference for leisure in the population, assume that $\lambda$ is known to the insurers) but do not have information regarding the preference type of particular individuals.\(^6\)

At the end of each period every employee is informed of whether he is being retained or laid off. Individuals who seek employment for the upcoming period, whether they were previously employed or not, must make an effort to inform potential employers of their availability. We assume that the prospect of being retained by his current employer improves with the effort, $e$, exerted by an employee while working; if the employee is laid off, the chance of securing new employment increases with the effort, $e$, the employee makes searching for new employment. Henceforth $e$ and $e$ are normalized so that $(e, e) \in [0, 1]^2$. Let $p(e)$ and $q(e)$ denote, respectively, the probability that the employee is retained for the next period if he chooses to exert effort $e$ and the probability of finding new employment as a function of the search effort $e$. We assume that

\(^6\)For expository convenience we assume that all firms are identical, and hence the performance of firms is not a source of private information.
\( p(\cdot) \) and \( q(\cdot) \) are strictly monotonic increasing, twice-differentiable concave functions and that \( q(0) = 0 \) (i.e., if the employee does not exert any effort searching, he will not find new employment). This formulation captures the idea that the probability of being laid off is mainly a function of the effort exerted by the employee in discharging his duties, whereas the chance of securing new employment depends on his job search effort. When the labor market closes, unemployed workers collect unemployment insurance benefits according to the terms of the unemployment insurance policies they hold.

B. Preferences

Each individual in this economy is endowed with one unit of time per period, which he may allocate between work and leisure. Denote by \( l \) the amount of leisure and let \( w \) denote the wage rate. If we ignore nonlabor income for expository convenience, the preferences of an individual of type \( \gamma \in [\gamma_0, \gamma_1] \) between income and leisure are represented by a utility function \( u(w(1 - l), \gamma l) \). We assume throughout that \( u(\cdot, \cdot) \) is a real-valued, monotonic increasing, twice continuously differentiable concave function and that \( u_{12} > 0 \).\(^7\) Moreover, we assume that type \( \gamma_1 \) employees prefer working full-time and that type \( \gamma_0 \) employees prefer not to work at all at the current wage rate.\(^8\)

Individuals are expected utility maximizers, and their preferences over income, leisure, and the two kinds of efforts are represented by a von Neumann–Morgenstern utility function that is additively separable in effort. Formally, the preferences of type \( \gamma_1 \) individuals are represented by the expected utility functional

\[
 p(e) u(w, 0) + [1 - p(e)]
 \times [q(e) u(w, 0) + [1 - q(e)] u(0, \gamma_1) - e] - e. \tag{1}
\]

Type \( \gamma_0 \) individuals will resign if they are not laid off and will not look for a new job if they are laid off. Thus the preferences of individuals of this type are represented by \( u(0, \gamma_0) \).

\^7\ The term \( u_1 \) denotes the partial derivative of \( u \) with respect to the \( j \)th argument. Similarly, \( u_{ij} \) denotes the partial derivative of \( u_i \) with respect to the \( i \)th argument.

\^8\ Formally, \( \max_{w(1 - l), \gamma l} u(w, 0) \), whereas \( \max_{w(1 - l)} u(w, 0) \gamma_1 = u(0, \gamma_0) \). These conditions hold if \(-u_1(w, 0)w + u_2(w, 0)\gamma_1 < 0 \) and \(-u_1(0, \gamma_0)w + u_2(0, \gamma_0)\gamma_0 > 0.\)
C. Unemployment Insurance

Insurance policies are represented by pairs of numbers, \((\alpha, \beta)\), where \(\alpha\) denotes the insurance premium and \(\beta\) is the net indemnity (i.e., the unemployment insurance benefits). The presence of moral hazard means that the availability of unemployment insurance affects the level of effort exerted in discharging one’s duties while employed as well as the level of effort exerted in searching for a new job in the event of being laid off. The potential for adverse selection implies that insurers may offer alternative insurance policies designed to attract specific individual types.

To analyze the market for unemployment insurance, we adopt the definition of insurance market equilibrium with adverse selection of Rothschild and Stiglitz (1976), appropriately modified to accommodate the moral hazard aspect of our model. Let \(C\) be a set of all unemployment insurance policies, denote by \(c^0\) the policy \((0, 0)\) (i.e., the option of not taking out unemployment insurance), and suppose that \(c^0 \in C\). Let \(I\) denote the set of employees eligible for unemployment insurance in the current period. For each \(C' \subset C\) and \(c \in C'\), denote by \(I(c; C') \subset I\) the subset of employees who prefer \(c\) to every element of \(C'\).\(^9\) Let \(\mu[\gamma|I(\hat{c}; C')]\) denote the proportion of type \(\gamma\) employees in \(I(c; C')\). Then for every \(c \in C'\) and \(C' \subset C\), let \(\pi(c; C')\) denote the average probability of unemployment of individuals holding \(c\). Formally,

\[
\pi(c; C') = \sum_{\gamma} \mu[\gamma|I(c; C')] \left[ 1 - p(\epsilon^*(c, \gamma)) \right] \left[ 1 - q(\epsilon^*(c, \gamma)) \right],
\]

where \(\epsilon^*(c, \gamma)\) and \(\epsilon^b(c, \gamma)\) denote the optimal levels of effort of a type \(\gamma\) individual holding the unemployment insurance policy \(c\).

A competitive equilibrium in the unemployment insurance market is a set of policies such that (a) each policy in the equilibrium set is actuarially sound given the subset of employees that buy it, and (b) any policy not in the equilibrium set, if it were offered in addition to the policies already in the set, is actuarially unsound given the population that it will attract. Formally, we make the following definition.\(^{10}\)

**Definition 1.** A set of insurance contracts \(C^*\) constitutes an equi-

\(^9\) Formally, let \(U^*_i(c)\) denote the maximal expected utility of individual \(i\) under an unemployment insurance policy \(c\), taking into account that the individual exerts the optimal levels of effort. Then \(I(\hat{c}; C') = \{i \in I| U^*_i(\hat{c}) \geq U^*_i(c) \forall c \in C'\}\).

\(^{10}\) For alternative equilibrium concepts, see Miyazaki (1977), Wilson (1977), Grossman (1979), and Riley (1979).
librium if the following two conditions hold: (a) For each \( c = (\alpha, \beta) \in C^* \),

\[ \alpha \geq \frac{\pi(c; C^*)}{1 - \pi(c; C^*)} \beta. \]

(b) For any contract \( c' = (\alpha', \beta') \not\in C^* \),

\[ \alpha' < \frac{\pi(c'; C^* \cup \{c'\})}{1 - \pi(c'; C^* \cup \{c'\})} \beta'. \]

A nonempty set of equilibrium contracts \( C^* \) constitutes a pooling equilibrium if, for some \( c \in C^* \), \( I(c; C^*) \) consists of more than one type of employees; otherwise it is a separating equilibrium.

In equilibrium the terms of the insurance policy are determined jointly with the levels of effort. Given an unemployment insurance policy \((\alpha, \beta)\), a type \( \gamma \) employee chooses levels of effort, \( e \) and \( E \), so as to maximize

\[
p(\epsilon) u(w - \alpha, 0) + [1 - p(\epsilon)] \\
\times \{ q(\epsilon) u(w - \alpha, 0) + [1 - q(\epsilon)] u(\beta, \gamma) - e \} - \epsilon.
\]

The necessary conditions are

\[
p'(e^*) (u(w - \alpha, 0) - q(e^*) u(w - \alpha, 0) \\
+ [1 - q(e^*)] u(\beta, \gamma) - e^*)) = 1
\]

and

\[ q'(e^*) [u(w - \alpha, 0) - u(\beta, \gamma)] = 1. \]

Since type \( \gamma_0 \) employees resign if not laid off, the fact that \( u(-\alpha, \gamma_0) - u(\beta, \gamma_0) < 0 \) implies \( e^* = e^* = 0 \). Thus their objective function attains the value

\[
p(0) u(-\alpha, \gamma_0) + [1 - p(0)] u(\beta, \gamma_0).
\]

The objective function of type \( \gamma_1 \) employees is concave in \( e \) and \( \epsilon \). We assume that the optimization problem has an interior solution, which we denote by \((e^*(\alpha, \beta; \gamma_1), e^*(\alpha, \beta; \gamma_1))\). It is easy to verify

11 The expression \( u(-\alpha, \gamma_0) - u(\beta, \gamma_0) < 0 \) implies \( q'(e^*) [u(-\alpha, \gamma_0) - u(\beta, \gamma_0)] - 1 < 0 \). Thus \( e^* = 0 \). But \( q(0) = 0 \); hence, the derivative of the objective function with respect to \( \epsilon \) is negative, implying \( e^* = 0 \).

12 Clearly, \( e^*(\alpha, \beta; \gamma_1) \) depends on \( q \) and \( e^*(\alpha, \beta; \gamma_1) \) depends on \( p \) and \( q \). To simplify the exposition where there is no ambiguity, we suppress these arguments.
that our assumptions about the utility function imply that $e_\beta^* < 0$, $e_\alpha^* < 0$, $e_\gamma^* < 0$, and $e_\delta^* < 0$.

If all private information regarding the hidden characteristics (but not hidden actions) was made public, then fair unemployment insurance for type $\gamma_1$ employees requires that

$$p(e^*(\alpha, \beta; \gamma_1)) + [1 - p(e^*(\alpha, \beta; \gamma_1))]q(e^*(\alpha, \beta; \gamma_1))\alpha = [1 - p(e^*(\alpha, \beta; \gamma_1))[1 - q(e^*(\alpha, \beta; \gamma_1))]\beta.$$  \hspace{1cm} (7)

Fair unemployment insurance for type $\gamma_0$ employees requires that

$$p(0)\alpha = [1 - p(0)]\beta.$$  \hspace{1cm} (8)

Notice, however, that because of risk aversion, type $\gamma_0$ employees reject all fair unemployment insurance policies except the trivial policy $\alpha = 0, \beta = 0$.

In reality, however, $\gamma$ is private information. Thus the actuarial value of an unemployment insurance policy depends on the type of employees it attracts. In particular, for every employee type the corresponding fair unemployment insurance policy has the properties that the premium is an increasing convex function of the unemployment benefits up to the point at which these benefits are sufficiently large to reduce the level of effort to zero. It is an increasing linear function of the benefits from there on. These properties are summarized in proposition 1 and are depicted in figure 1, where the curves represent actuarially fair premium-indemnity pairs.

**Proposition 1.** For every given population type $\gamma$ and unemployment benefits $\beta$, let $\hat{\alpha}(\beta|\gamma)$ denote the premium that would make the policy ($\hat{\alpha}(\beta), \beta$) actuarially fair if sold solely to type $\gamma$ individuals. Then there exists $\beta^0 \geq 0$ such that $\hat{\alpha}(\beta|\gamma)$ is a monotonic increasing convex function on $[0, \beta^0)$ and is a monotonic increasing and linear function on $[\beta^0, \infty)$.

The proof of proposition 1 is given in the Appendix.

From (4) and (5) we know that, for type $\gamma_1$ individuals, $e^* = 0 = e^*$ if and only if $u(w - \alpha, 0) \leq u(\hat{\beta}, \gamma_1)$. Following Arnott and Stiglitz (1988), we define the zero-effort locus (ZEL) by $\{(\alpha, \beta)|u(w - \alpha, 0) = u(\hat{\beta}, \gamma_1)\}$. Let $Z$ denote the set of unemployment insurance contracts such that $e^*(\alpha, \beta; \gamma_1) = 0$ (i.e., $Z = \{\alpha, \beta\in \mathbb{R}^2|u(w - \alpha, 0) \leq u(\hat{\beta}, \gamma_1)\}$); then, for type $\gamma_1$ individuals, since $u(w, 0) > u(0, \gamma_1)$, $(0, 0) \not\in Z$ (see fig. 1).

From (3), individual preferences on $(\alpha, \beta)$ are represented by

$$p(e^*(\alpha, \beta))u(w - \alpha, 0) + [1 - p(e^*(\alpha, \beta))] \times \{q(e^*(\alpha, \beta))u(w - \alpha, 0)$$

$$+ [1 - q(e^*(\alpha, \beta))]u(\beta, \gamma) - e^*(\alpha, \beta) - e^*(\alpha, \beta).$$
The marginal rate of substitution between the premium, \( \alpha \), and the net unemployment benefits, \( \beta \), is the outcome of two factors: risk aversion and moral hazard. Risk aversion alone implies that the marginal rate of substitution is decreasing. Moral hazard alone implies that the marginal rate of substitution is increasing. The combined effect depends on the relative strengths of these opposing forces. We state this formally in the following proposition.

**Proposition 2.** (a) If \( u \) is concave in its first argument and \( \varepsilon^*_\beta + \varepsilon^*_\alpha (d\alpha/d\beta) \) and \( \varepsilon^*_\beta + \varepsilon^*_\alpha (d\alpha/d\beta) \) are sufficiently small, then \( (d\alpha/d\beta)\big|_{u=\text{const.}} \) is everywhere positive and decreasing in \( \beta \). (b) If \( u \) is linear in its first argument, then \( (d\alpha/d\beta)\big|_{u=\text{const.}} \) is everywhere positive and increasing in \( \beta \).

The proof of proposition 2 is given in the Appendix.

**Corollary.** For type \( \gamma_0 \) employees, \( (d\alpha/d\beta)\big|_{u=\text{const.}} \) is everywhere positive and decreasing in \( \beta \).

The corollary follows directly from part a of proposition 2 since \( e^* = \varepsilon^* = 0 \) implies \( \varepsilon^*_\beta + \varepsilon^*_\alpha (d\alpha/d\beta) = \varepsilon^*_\beta + \varepsilon^*_\alpha (d\alpha/d\beta) = 0 \).

In general the indifference curves may be concave in part and convex in part depending on whether risk aversion or moral hazard is the dominant effect.
III. Moral Hazard and Adverse Selection

A. Employee's Type and Endogenous Adverse Selection

Endogenous adverse selection arises as a consequence of the interaction between the unobservable levels of effort and the employee's preferences for leisure. This problem afflicts the unemployment insurance market since effort is difficult to monitor and employees may experience periods during which they would rather be unemployed.

If a separating equilibrium exists, it consists of two unemployment insurance policies: a fair insurance policy, \( c^H = (\alpha^H, \beta^H) \), for high-risk employees (i.e., type \( \gamma_0 \) employees) and a fair insurance policy, \( c^L = (\alpha^L, \beta^L) \), for low-risk employees (i.e., type \( \gamma_1 \) employees) designed not to attract the high-risk employees. Note, however, that for high-risk employees the only unemployment insurance policies that are actuarially sound satisfy

\[ \alpha = \frac{1 - p(0)}{p(0)} \beta. \]  

(9)

The next result shows that there exist no actuarially sound non-trivial insurance policies that are acceptable to the high-risk employees.

**Proposition 3.** The only actuarially sound unemployment insurance policy that is acceptable to type \( \gamma_0 \) employees is \( (\alpha, \beta) = (0, 0) \).

The proof of proposition 3 is given in the Appendix. Note that for type \( \gamma_0 \) employees the marginal rate of substitution at \( \alpha = \beta = 0 \) is equal to the slope of the actuarially fair insurance line. Formally,

\[ \frac{d\alpha}{d\beta} \bigg|_{u=\text{const.}} (0, 0) = \frac{1 - p(0)}{p(0)}. \]  

(10)

Moreover, by the corollary to proposition 2, for employees of this type the indifference curve through \( \alpha = \beta = 0 \) is concave throughout (see fig. 2).

Consequently, in equilibrium, type \( \gamma_1 \) employees are offered an unemployment insurance policy that solves the following optimization problem: Choose an insurance contract \( (\alpha, \beta) \) so as to maximize

\[
\rho(e^*(\alpha, \beta; \gamma_1)) u(w - \alpha, 0) + [1 - \rho(e^*(\alpha, \beta; \gamma_1))] \\
\times [q(e^*(\alpha, \beta; \gamma_1)) u(w - \alpha, 0)] \\
+ [1 - q(e^*(\alpha, \beta; \gamma_1))] u(\beta, \gamma_1) - e^*(\alpha, \beta; \gamma_1) - e^*(\alpha, \beta; \gamma_1)
\]
subject to the fairness constraint

\[
\alpha = \frac{[1 - p(e^*(\alpha, \beta; \gamma_1))][1 - q(e^*(\alpha, \beta; \gamma_1))]}{1 - [1 - p(e^*(\alpha, \beta; \gamma_1))][1 - q(e^*(\alpha, \beta; \gamma_1))]} \beta
\]

and the incentive compatibility constraint, which in view of proposition 3 may be written as

\[
u(0, \gamma_0) \geq p(0)u(-\alpha, \gamma_0) + [1 - p(0)]u(\beta, \gamma_0).
\] (11)

B. The Main Result

With propositions 1, 2, and 3 in mind, we now describe the implications of endogenous adverse selection for the unemployment insurance market. The fact that the hidden characteristic giving rise to adverse selection is the employee's preference for leisure (as opposed to the accident probability in the usual analysis) coupled with the potential for hidden action gives rise to adverse selection equilibria that are, in some cases, quite different from those encountered in the conventional analysis of insurance markets with adverse selection. The most important implication is that an equilibrium may exist in which no unemployment insurance is available. To state this result we need to introduce the following additional notation: Given
a monotonic increasing function $p(e)$ representing the probability of being retained by the current employer, let \( \Pi(\lambda \gamma_1 + (1 - \lambda) \gamma_0; p) \) denote the set of unemployment insurance contracts that are actuarially profitable if sold to a population that consists of types $\gamma_1$ and $\gamma_0$ in proportions $\lambda$ and $1 - \lambda$, respectively. Formally,

\[
\Pi(\lambda \gamma_1 + (1 - \lambda) \gamma_0; p) = \{(\alpha, \beta) | \alpha \geq \lambda \hat{\alpha}(\beta|\gamma_1) + (1 - \lambda) \hat{\alpha}(\beta|\gamma_0), \beta \geq 0\}.
\]

Let $S(0, 0; \gamma, p)$ denote the upper contour set of type $\gamma$ individuals corresponding to the unemployment insurance policy $(0, 0)$. Define $J(\gamma_1; p) = S(0, 0; \gamma_1, p) \cap \Pi(\gamma_1; p)$, where $\Pi(\gamma_1; p) = \Pi(\lambda \gamma_1 + (1 - \lambda') \gamma_0; p)$, with $\lambda' = 1$. Let $\lambda$ denote the proportion of type $\gamma_1$ employees in the population. It is easy to verify that if (i) and (ii) then there exists a unique competitive equilibrium in the unemployment insurance market in which the only unemployment insurance policy is $(0, 0)$; that is, no unemployment insurance is supplied in equilibrium.

To grasp the idea, observe in figure 2 that the set of viable unemployment insurance contracts that are acceptable to type $\gamma_1$ individuals is contained in that of type $\gamma_0$ individuals (condition i). This condition excludes the possibility of a separating equilibrium. Condition ii implies that any nontrivial pooling contract—that is, $(\alpha, \beta) \in \Pi(\lambda \gamma_1 + (1 - \lambda) \gamma_0; p)$—is unacceptable to type $\gamma_1$ individuals and therefore may not be an equilibrium. Together these conditions imply that the only equilibrium possible is the no unemployment insurance equilibrium. Clearly, condition ii is satisfied only if $\lambda < 1$. In other words, the result depends critically on whether the measure of type $\gamma_0$ in the population is strictly positive. Henceforth we assume that $1 - \lambda > 0$.

Next we show that if the probability of retaining a job when the level of effort exerted in discharging one’s duties is zero is sufficiently small, then an equilibrium with no unemployment insurance is typical.

\[13\] Formally, $S(0, 0; \gamma, p) = \{(\alpha, \beta) | (\alpha, \beta) \preceq_\gamma (0, 0)\}$, where $\preceq_\gamma$ denotes the preference relation of a type $\gamma$ individual on the set of all unemployment insurance policies.

\[14\] If $\lambda = 1$, then $\Pi(\lambda \gamma_1 + (1 - \lambda) \gamma_0; p) \cap J(\gamma_1; p) = J(\gamma_1; p)$. Hence, the equilibrium unemployment insurance contract is the optimal contract for type $\gamma_1$ employees in the set $\Pi(\gamma_1; p)$. 
THEOREM. Given $\lambda < 1$, let $p(\cdot)$ be a strictly monotonic increasing concave probability function such that $(\alpha, \beta) \in J(\gamma_1, p)$ implies $e^*(\alpha, \beta; \gamma_1, p) > 0$. Then there is a number $r > 0$ such that conditions i and ii hold for all monotone increasing concave functions $\hat{p}(\epsilon)$ such that $\hat{p}(0) < r$ and $\hat{p}(\epsilon) = p(\epsilon)$ for all $\epsilon \geq \epsilon'$, where $0 < \epsilon' = \inf\{e^*(\alpha, \beta; \gamma_1, p) \vert (\alpha, \beta) \in J(\gamma_1, p)\}$.

The proof of the theorem is given in the Appendix. It shows that $\hat{p}(0)$ need not be very small for the theorem to hold. Specifically, other things being equal, the higher the level of effort $e^*(0, 0; \gamma_1, \hat{p})$ (i.e., the effort exerted by type $\gamma_1$ employees in the absence of unemployment insurance), the lower along the ZEL is the point at which the indifference curve through the origin intersects the ZEL, and $\hat{p}(0)$ need not be very small for conditions i and ii to hold. Moreover, if the difference between $\hat{p}(0)$ and $\hat{p}(e^*(0, 0; \gamma_1, \hat{p}))$ is sufficiently large, then no private unemployment insurance will be offered in a competitive equilibrium. This observation may explain the universal absence of private unemployment insurance.

The proof also shows that the larger the proportion of type $\gamma_0$ employees in the population eligible for unemployment insurance (i.e., the larger $1 - \lambda$ is), the larger $\hat{p}(0)$ can be for the conclusion to still hold. Consequently, the likelihood that no unemployment insurance exists rises with the number of labor force participants who voluntarily take time off.

IV. Concluding Remarks

A. Role of the Public Sector

The analysis of the preceding section identifies potential sources of private information that may undermine the ability of the private sector to provide unemployment insurance. Under these circumstances, competitive equilibrium is not necessarily Pareto optimal, and Pareto-improving public unemployment insurance potentially exists. This does not mean that existing unemployment insurance programs are better than equilibrium with no unemployment insurance. In fact, our discussion suggests that the existing unemployment insurance programs of the public sector do not constitute Pareto improvement over the no unemployment insurance equilibrium. To begin with, we observe that the same conditions that entail a no unemployment insurance equilibrium (see the hypothesis of the theorem) preclude the existence of a self-financing pooling unemployment insurance policy that is preferred by the low-risk employees over no insurance. Put differently, the low-risk employees would rather go without unemployment insurance than pay the additional premium required to subsidize the high-risk employees under a pooling policy. However, as shown by Crocker and Snow
(1985), a competitive equilibrium in an insurance market with adverse selection is not necessarily Pareto optimal and may be improved on by a self-financing insurance program that offers separate policies to high-risk and low-risk employees with cross-subsidization. Applying this result to unemployment insurance would require that employees be allowed to choose among unemployment insurance policies to bring about the self-selection. This is not the current practice in countries in which unemployment insurance exists. Existing unemployment insurance programs are mandated pooling insurance that leaves individual employees no real choice in terms of coverage and premium.¹⁵

The business cycle is a source of aggregate unemployment risk that must be borne by the insurance underwriters. This tends to hinder the provision of private unemployment insurance since it means that the insurance premiums must be high enough to compensate the underwriters for the risk they are required to bear and may be used as an argument in favor of public provision of unemployment insurance. A discussion of this issue is beyond the scope and purpose of the present paper. However, we note that, in itself, the presence of aggregate risk does not imply that no private unemployment insurance is viable. Indeed, in other areas aggregate risk does not preclude private provision of some insurance (e.g., pension funds and life insurance in the presence of unanticipated variations in mortality rates; see Diamond [1993]). Moreover, public unemployment insurance shifts the aggregate risk to taxpayers. This is likely to result in inefficient allocation of risk bearing since the allocation is not done according to the inclination of individuals to bear this risk. In countries with developed financial markets, private stock insurance companies may attain more efficient allocation of unemployment risk by allowing the shareholders to decide how much risk they are willing to bear.

B. Firm Type Adverse Selection

Our explanation of the absence of private unemployment insurance focused on the interaction of moral hazard associated with the imperfect observability of the level of effort exerted in performing one’s job and adverse selection resulting from private information regarding employees’ preferences for work. Another potential source of adverse selection in unemployment insurance has to do

¹⁵ It may well be that the explanation for the prevalence of mandated pooling unemployment insurance programs should be sought in the context of some general welfare policy and not as a response to the failure of the private unemployment insurance market.
with firm-specific conditions that affect future employment prospects and are observable by employees of the firm but not by outsiders. For instance, employees may perceive well in advance of outside insurers that, because of insufficient orders, reorganization of the firm’s operation, or plans to install new equipment, they are likely to be laid off. Such employees represent higher risks and are more inclined to take out unemployment insurance. The experience with Career Guard, a Canadian unemployment insurance plan, designed for executives and introduced during the 1982–83 recession, serves to highlight the problem:

Although this insurance policy did not cover executives fired within 6 months of purchasing insurance, the entrepreneurs who started Career Guard nonetheless discovered that a very high proportion of those who purchased insurance were dismissed by their employers subsequent to the 6-month qualifying period. It appeared that Career Guard failed primarily because of adverse selection—those executives who knew they were likely to be dismissed were the main purchaser of insurance, and the insurer could not distinguish high-risk from low-risk customers. [Green and Ridell 1993, p. S99]

This, however, is not essentially different from the usual problem encountered in the analysis of insurance markets with adverse selection and may easily be incorporated into our model by introducing firm types and assuming that, for each given level of effort exerted in discharging their duties, the probability of being retained at the end of the current period is higher for employees of expanding firms than it is for employees of contracting firms. Except for the modification required by the presence of moral hazard, the analysis of firm type adverse selection is not essentially different from that of Rothschild and Stiglitz (1976) and is not pursued here.

Another issue concerning firm-specific risk has to do with the effect of unemployment insurance on temporary layoffs. Firms experience variations in demand, to which they respond, in part, by temporary layoffs. The availability of unemployment insurance makes both firms and workers more willing to accept temporary layoffs as a response to lower demand. Moreover, there are substantial differences in the variations in the demand faced by different firms, which means that the unemployment risk associated with different firms may be different. In principle, this problem could be dealt with by experience rating. However, imperfect experience rating may create a moral hazard problem. For instance, in the United States the payroll tax imposed on employers does not reflect accurately the varia-
tions in layoffs among firms, and as a result, firms that lay off fewer employees subsidize those that lay off more employees. Since firms have control over the number of layoffs, this cross-subsidization contributes to unemployment (see Feldstein 1976, 1978; Topel and Welch 1980; Topel 1983, 1984).

It is interesting to note that to the extent that imperfect experience rating increases the probability of entering the unemployment state of all employees, it reinforces our argument since it tends to increase the likelihood of competitive equilibrium with no unemployment insurance.

C. Related Literature

The literature dealing with unemployment insurance includes a variety of models designed to highlight different aspects of the problem of risk sharing and incentives. Shapiro and Stiglitz (1984) present a model in which involuntary unemployment is an equilibrium phenomenon whose purpose is to deter shirking. The provision of unemployment benefits tends to reduce the deterrence effect, and consequently, in equilibrium, unemployment compensation paid by employers does not exceed the legal minimum. This model was not designed for nor does it explain the absence of private provision of unemployment insurance by private insurance companies.

Jones (1986) models a labor market with adverse selection in which employees have private information about their ability, and each employee’s reservation wage is a monotonic increasing function of his or her ability. Firms offer uniform wages and use random devices to ration the employment among job applicants. This procedure results in involuntary unemployment. Jones shows that, even if employees are risk averse, in equilibrium, profit-maximizing behavior requires that firms refrain from offering unemployment insurance to job applicants against the event of being denied employment. Jones’s argument has to do with efficiency of hiring practices and does not explain the nonexistence of private provision of unemployment insurance by outside insurers.

The incentive effects of unemployment insurance on the search for and willingness to accept new employment have been a central issue in the literature. Hansen and Imrohoroglu (1992) study the welfare implications of unemployment insurance in a dynamic general equilibrium model in which imperfect monitoring of individuals’ acceptance of a job offer gives rise to the moral hazard problem. They conclude that, unless the replacement ratio is set optimally, unemployment insurance may result in welfare loss. More recently, Hopenhayn and Nicolini (1997), building on the work of Shavell
and Weiss (1979), show that, in the presence of the aforementioned moral hazard problem, optimal unemployment insurance requires that the replacement ratio decreases with the duration of the unemployment spell and that a wage tax is imposed after reemployment.

Analytical tractability and expository considerations require that theoretical models of unemployment insurance depart from important institutional characteristics of actual unemployment insurance programs (Atkinson and Micklewright [1991] provide a list of the most important departures and discuss their implications). Our model is no exception. Its objective is to highlight conditions under which a competitive equilibrium with no unemployment insurance is likely to arise, and therefore, by design, it abstracts from institutional aspects of unemployment insurance that are not essential for the purpose at hand. Moreover, the institutional features listed by Atkinson and Micklewright pertain to unemployment insurance programs provided by the public sector, whereas we model private unemployment insurance. Having said that, we note that several institutional features on Atkinson and Micklewright’s list either are implicit in the model or could be incorporated without altering the main conclusions. First, in our model, unemployment insurance may be taken out by eligible (i.e., currently employed) employees and benefits are refused to employees who enter unemployment voluntarily or as a result of industrial misconduct. This reduction in the level of shirking does not change the qualitative conclusions. Second, in practice, unemployment insurance benefits are paid for a limited duration, and the rate of benefits may decline over time. An explicit analysis of these features would require treating the duration of unemployment as a random variable whose distribution is affected by the job search effort. We avoided this complication by treating the probability of finding new employment as a function of the level of job search effort. However, as we have seen, the (hidden) effort exerted in searching for new employment is not essential for our results. Thus explicit treatment of the duration of unemployment will not alter the main conclusions.

Appendix

A. Proof of Proposition 1

From equation (8), the fair insurance locus for type $y_0$ employees is linear and is given by

$$\alpha(\beta) = \frac{1 - p(0)}{p(0)}\beta.$$ 

For type $y_1$ employees, the slope of the fair insurance line is (we suppress the arguments of $p$ and $q$ for simplicity)
\[
\frac{d\hat{\alpha}}{d\beta} = \frac{(1 - p)(1 - q) - (\hat{\alpha} + \beta)[(1 - q)p'\epsilon^\#_p + (1 - p)q'\epsilon^\#_q]}{p + (1 - p)q + (\hat{\alpha} + \beta)[(1 - q)p'\epsilon^\#_p + (1 - p)q'\epsilon^\#_q]} \geq \frac{(1 - p)(1 - q)}{p + (1 - p)q} = \check{\alpha}.
\]

where the inequality follows from the fact that, for all \((\alpha, \beta)\) such that \(\epsilon^*(\alpha, \beta) > 0, (1 - q)p'\epsilon^\#_p + (1 - p)q'\epsilon^\#_q < 0\) and \((1 - q)p'\epsilon^\#_p + (1 - p)q'\epsilon^\#_q < 0\). Thus \(\check{\alpha}(\beta)\) is convex for all \(\beta\) such that \(\epsilon^*(\check{\alpha}(\beta), \beta) > 0\) or \(\epsilon^*(\check{\alpha}(\beta), \beta) > 0\).

Let
\[
\beta_0 = \sup\beta : 0|\epsilon^*(\check{\alpha}(\beta), \beta) = e^*(\check{\alpha}(\beta), \beta) = 0).
\]

Then, for \(\beta \geq \beta_0\),
\[
\check{\alpha}(\beta) = \frac{1 - p(0)}{p(0)} \beta.
\]

Q.E.D.

B. Proof of Proposition 2

To begin with, observe that, by the envelope theorem, the slope of the indifference curve of type \(\gamma_1\) employees is
\[
\frac{d\alpha}{d\beta} = \frac{[1 - p(\epsilon^*)][1 - q(\epsilon^*)]u_1(\beta, \gamma_1)}{[p(\epsilon^*) + [1 - p(\epsilon^*)]q(\epsilon^*)]u_1(w - \alpha, 0)} > 0.
\]

Thus the indifference curves are monotonic increasing. Let the expression in the numerator be denoted by \(N\) and that in the denominator by \(M\).

Differentiating the expression above with respect to \(\beta\), we get
\[
\frac{d^2\alpha}{d\beta^2} = \frac{1}{M^2} \left[ M \left[ [1 - p(\epsilon^*)][1 - q(\epsilon^*)]u_{11}(\beta, \gamma_1) - u_1(\beta, \gamma_1) \left\{ p'(\epsilon^*) [1 - q(\epsilon^*)] \left( \epsilon^\#_p + \epsilon^\#_q \frac{d\alpha}{d\beta} \right) 
+ q'(\epsilon^*) [1 - p(\epsilon^*)] \left( \epsilon^\#_p + \epsilon^\#_q \frac{d\alpha}{d\beta} \right) \right\} \right]
\]
\[
+ N \left[ [p(\epsilon^*) + [1 - p(\epsilon^*)]q(\epsilon^*)]u_{11}(w - \alpha, 0) \frac{d\alpha}{d\beta}
- u_1(w - \alpha, 0) \left\{ p'(\epsilon^*) [1 - q(\epsilon^*)] \left( \epsilon^\#_p + \epsilon^\#_q \frac{d\alpha}{d\beta} \right)
+ q'(\epsilon^*) [1 - p(\epsilon^*)] \left( \epsilon^\#_p + \epsilon^\#_q \frac{d\alpha}{d\beta} \right) \right\} \right].
\]
Thus
\[
\frac{d^2 \alpha}{d \beta^2} = \frac{N}{M} \left[ \frac{u_{11}(\beta, \gamma_1) + u_{11}(w - \alpha, 0)}{u_1(\beta, \gamma_1)} \right] - \frac{1}{M^2} \left[ u_1(\beta, \gamma_1) M + u_1(w - \alpha, 0) N \right]
\times \left\{ p'(e^*) [1 - q(e^*)] \left( e^*_\beta + e^*_\alpha \frac{d \alpha}{d \beta} \right) + [1 - p(e^*)] q'(e^*) \left( e^*_\beta + e^*_\alpha \frac{d \alpha}{d \beta} \right) \right\}.
\]

Since \( u \) is concave in its first argument, the first expression above is negative. Hence, if \( e^*_\beta + e^*_\alpha (d \alpha / d \beta) \) and \( e^*_\beta + e^*_\alpha (d \alpha / d \beta) \) are sufficiently small, then the whole expression is negative, which is the conclusion of part a of proposition 2.

Suppose next that \( u \) is linear in its first argument. Then the numerator of the expression above is
\[
- \left[ u_1(\beta, \gamma_1) M + u_1(w - \alpha, 0) N \right] \left\{ p'(e^*) [1 - q(e^*)] \left( e^*_\beta + e^*_\alpha \frac{d \alpha}{d \beta} \right) + [1 - p(e^*)] q'(e^*) \left( e^*_\beta + e^*_\alpha \frac{d \alpha}{d \beta} \right) \right\}.
\]

But the optimality of \( e^* \) and \( e^* \) implies
\[
e^*_\beta + e^*_\alpha \frac{d \alpha}{d \beta} = \frac{p'(e^*) [1 - q(e^*)] M [u_1(\beta, \gamma_1) M + u_1(w - \alpha, 0) N]}{G},
\]
and
\[
e^*_\beta + e^*_\alpha \frac{d \alpha}{d \beta} = \frac{q'(e^*) [1 - p(e^*)] [u_1(\beta, \gamma_1) M + u_1(w - \alpha, 0) N]}{H},
\]
where \( G \) and \( H \) denote the second derivatives of the expected utility functional with respect to \( e \) and \( e \). After substitution above, if \( u \) is linear in its first argument, then since \( G < 0 \) and \( H < 0 \),
\[
\frac{d^2 \alpha}{d \beta^2} = -\frac{1}{M^2} \frac{1}{G} \left[ u_1(\beta, \gamma_1) M + u_1(w - \alpha, 0) N \right] p'(e^*) [1 - q(e^*)] + \frac{1}{H} \left[ u_1(\beta, \gamma_1) M + u_1(w - \alpha, 0) N \right] \left( 1 - p(e^*) \right) q'(e^*) > 0.
\]

This completes the proof of proposition 2. Q.E.D.

C. Proof of Proposition 3

Consider a type \( \gamma_0 \) employee. Since such an employee prefers being unemployed, he will choose a level of effort \( e^* = 0 \) during the current period and \( e^* = 0 \) if he is laid off. Consequently, for such an employee type, the insurance contract \( c = (\alpha, \beta) \) is actuarially sound if \( p(0) \alpha \geq [1 - p(0)] \beta \).
If he is not laid off, the type \( \gamma_0 \) employee will quit his job. Hence, the employee's expected utility under the unemployment insurance \( \epsilon \) satisfies
\[
\epsilon(0) u(-\alpha, \gamma_0) + [1 - \epsilon(0)] u(\beta, \gamma_0) \leq u(0, \gamma_0)
\]
for all \( (\alpha, \beta) \gg (0, 0) \), where the inequality follows from Jensen's inequality, the fact that \( u \) is concave in its first argument, and the fact that the policy is actuarially sound. Q.E.D.

D. Proof of the Theorem

To begin with, we claim that if \( \epsilon \) is any given monotone increasing concave function such that \( \epsilon^*(0, 0; \gamma_1, \epsilon) > 0 \), then there is a number \( r \in [0, 1] \) such that, if \( \hat{\epsilon} \) is a monotone increasing function satisfying \( \hat{\epsilon}(0) \leq r \) and \( \hat{\epsilon}(\epsilon) = \epsilon(\epsilon) \) for all \( \epsilon > \epsilon^*(0, 0; \gamma_1, \epsilon) / 2 \), then \( \epsilon^*(\alpha, \beta; \gamma_1, \hat{\epsilon}) > 0 \) for all \( (\alpha, \beta) \in J(\gamma_1; \hat{\epsilon}) \).

To see this, since \( \epsilon(\epsilon) = \hat{\epsilon}(\epsilon) \) for \( \epsilon \geq \epsilon^*(0, 0; \gamma_1, \epsilon) / 2 \), note that \( \epsilon^*(0, 0; \gamma_1, \epsilon) > 0 \) and the optimality conditions (3) and (4) imply that \( \epsilon^*(0, 0; \gamma_1, \epsilon) = \hat{\epsilon}(\epsilon^*(0, 0; \gamma_1, \hat{\epsilon})) > 0 \). Next observe that the intersection with the ZEL of the indifference of type \( \gamma_1 \) employees that passes through the origin (see the point \( (\alpha_m, \beta_m) \) in fig. 1) is the same for \( \epsilon \) and \( \hat{\epsilon} \). To see this, denote by \( U^0(\epsilon) \) the expected utility of type \( \gamma_1 \) employees at \( (0, 0) \) corresponding to \( \epsilon \). Then since \( \epsilon^*(\alpha, \beta; \gamma_1, \epsilon) \) is on the same indifference curve, we have
\[
U^0(\epsilon) = \epsilon(0) u(w - \alpha_m, 0) + [1 - \epsilon(0)] u(\beta_m, \gamma_1) = u(w - \alpha_m, 0),
\]
where the last equality arises from the fact that, since \( (\alpha_m, \beta_m) \) is in the ZEL, \( u(w - \alpha_m, 0) = u(\beta_m, \gamma_1) \). But \( \epsilon(\epsilon^*(0, 0; \gamma_1, \epsilon)) = \hat{\epsilon}(\epsilon^*(0, 0; \gamma_1, \hat{\epsilon})) \). Hence, \( U^0(\epsilon) = U^0(\hat{\epsilon}) \), and \( (\alpha_m, \beta_m) \) is the same for \( \epsilon \) and \( \hat{\epsilon} \).

Since \( \epsilon^*(\alpha, \beta; \gamma_1, \epsilon) = \epsilon^*(\alpha, \beta; \gamma_1, \hat{\epsilon}) = 0 \) for all \( (\alpha, \beta) \in Z \), if follows from part a of proposition 2 that the indifference curve that passes through the origin is concave in the set \( Z \). Moreover, notice that the slope of this indifference curve at the point \( (\alpha_m, \beta_m) \) is
\[
\left. \frac{d\alpha}{d\beta} \right|_{\epsilon(\epsilon)} = \frac{[1 - \epsilon(0)] u_1(w - \alpha_m, 0)}{\epsilon(0) u_1(\beta_m, \gamma_1)} < \frac{[1 - \epsilon(0)] u_1(w - \alpha_m, 0)}{\epsilon(0) u_1(\beta_m, 0)},
\]
where the inequality is implied by \( u_{12} > 0 \). Moreover, the concavity of \( u \) in its first argument, the assumption that \( u_{12} > 0 \), and the fact that \( u(w - \alpha_m, 0) = u(\beta_m, \gamma_1) \) imply that \( w - \alpha_m > \beta_m \) and thus that
\[
\left. \frac{d\alpha}{d\beta} \right|_{\epsilon(\epsilon)} < \frac{[1 - \epsilon(0)] u_1(w - \alpha_m, 0)}{\epsilon(0) u_1(\beta_m, 0)} < \frac{[1 - \epsilon(0)] u_1(\beta_m, 0)}{\epsilon(0) u_1(\beta_m, 0)} = \frac{1 - \epsilon(0)}{\epsilon(0)} = \frac{1 - \epsilon(0)}{\epsilon(0)}.
\]

Let \( r \in [0, 1] \) be defined by
\[
\alpha_m = \frac{1 - r}{r} \beta_m.
\]
Then \( r > \hat{\epsilon}(0) \) implies that the sets \( \{ (\alpha, \beta) | \alpha \geq [1 - r] / r \beta \} \cap Z \) and \( S(0, 0; \gamma_1, \hat{\epsilon}) \cap Z \) are disjoint. Consequently, \( J(\gamma_1; \hat{\epsilon}) \) contains no unemployment insurance policy \( (\alpha, \beta) \) such that \( \epsilon^*(\alpha, \beta; \gamma_1, \hat{\epsilon}) = 0 \). But \( J(\gamma_1; \hat{\epsilon}) \) is a closed
set. Hence, for all \((\alpha, \beta) \in J(\gamma_1; \hat{p}), \epsilon^*(\alpha, \beta; \gamma_1, \hat{p}) > 0\). This establishes the validity of the claim.

In view of the claim, let \(p(\cdot)\) and the corresponding \(J(\gamma_1; \hat{p})\) be such that \(\epsilon^* = \inf\{\epsilon^*(\alpha, \beta; \gamma_1, \hat{p}) | (\alpha, \beta) \in J(\gamma_1, \hat{p})\} > 0\). Define a family of functions \(\{p(\cdot; t) : t \in [0, 1]\}\) as follows:

\[
p(\epsilon; t) = \begin{cases} 
p(\epsilon) & \text{for } \epsilon \in [\epsilon^*, 1] \\
p(t\epsilon) + (1 - t) \frac{\epsilon}{\epsilon^*} & \text{for } \epsilon \in [0, \epsilon^*].
\end{cases}
\]

Then \(p(0; t) \to 0\) as \(t \to 0\). Moreover, since variations in \(t\) do not affect the probability \(p(\cdot)\) for any level of effort, \(\epsilon\), induced by insurance policies in \(J(\gamma_1; \hat{p})\) (i.e., for any level of effort \(\epsilon > \epsilon^*\)), the set \(J(\gamma_1; \hat{p})\) is independent of \(t\).

For each \(p(\cdot, t)\), let \(S_0(0, 0; \gamma_0)\) be defined analogously to \(S(0, 0; \gamma_0, p)\). Let \((\alpha', \beta') \in J(\gamma_1, p)\). Note that \((0, 0) \in S_0(0, 0; \gamma_0) \cap J(\gamma_1, p) \cap \Pi(\lambda \gamma_1 + (1 - \lambda) \gamma_0)\). Since \(u(-\alpha; \gamma_0) < u(0; \gamma_0) < u(\beta; \gamma_0)\), we have

\[
pu(-\alpha'; \gamma_0) + (1 - p) u(\beta'; \gamma_0) \geq u(0; \gamma_0)
\]

for all

\[
P \leq \frac{u(\beta'; \gamma_0) - u(0; \gamma_0)}{u(\beta'; \gamma_0) - u(-\alpha'; \gamma_0)} = a > 0.
\]

Thus there is \(i' > 0\) such that, for all \(t \leq i'\), \((\alpha', \beta') \in S_0(0, 0; \gamma_0)\). This shows that, for sufficiently small \(t\), \(p(\cdot; t)\) satisfies condition i.

Next fix \(\beta'\) and let

\[
\hat{\alpha}_i(\beta' | \gamma_0) = \frac{1 - p(0; t)}{p(0; t)} \beta'.
\]

Thus \(\lim_{t \to 0} \hat{\alpha}_i(\beta' | \gamma_0) = \infty\). But \(\bar{x} \in (0, 1)\); hence \(\bar{\lambda} \hat{\alpha}(\beta' | \gamma_1) + (1 - \bar{\lambda}) \hat{\alpha}_r(\beta' | \gamma_0) \to \infty\) as \(t \to 0\). Thus, for sufficiently small positive \(t\), say \(i', \bar{\lambda} \hat{\alpha}(\beta' | \gamma_1) + (1 - \bar{\lambda}) \hat{\alpha}_r(\beta' | \gamma_0) > \alpha'\). Thus \((\alpha', \beta') \in \Pi(\bar{\lambda} \gamma_1 + (1 - \bar{\lambda}) \gamma_0)\).

If \(\beta' = 0\), then \(\hat{\alpha}_i(\beta' | \gamma_0) = 0\) for all \(t\) and \((0, 0) \in \Pi(\bar{\lambda} \gamma_1 + (1 - \bar{\lambda}) \gamma_0)\).

Together they imply condition ii.

Define \(t' = \inf\{\min\{\hat{i'}, i'\}|(\alpha', \beta')\}\) and \(r = p(0; t')\). Let \(\hat{p}: [0, 1] \to [0, 1]\) be any monotonic increasing concave function such that \(\hat{p}(0) < r\), and \(\hat{p}(\epsilon) = p(\epsilon)\) for all \(\epsilon \in [\epsilon^*, 1]\). Then, given \(\hat{p}\), conditions i and ii hold. Q.E.D.

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ENDOGENOUS ADVERSE SELECTION


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