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Health Insurance: Treatment vs. Compensation*

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Abstract

In this paper, we view health insurance as a combined hedge against the two consequences of falling ill: treatment expenditures and loss in income. We discuss how an individual's ability when healthy affects her decision on whether to buy health insurance with treatment to full recovery if ill or with partial treatment combined with cash compensation for the resulting loss in income. We find that a high-ability individual demands full recovery and is fully insured, while a low-ability individual demands partial treatment and cash compensation and is only partly insured.

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1 Introduction

Individuals face an inevitable risk of falling ill, thus suffering a loss in health. Health insurance provides a hedge against the consequences of falling ill. Like most types of insurance, it offers compensation to the insured if the insured-against event occurs. Unlike most insurance, however, the compensation may take two distinctly different forms: The health insurance policy may either provide for coverage of medical expenditures (in part or in whole), or it may provide for a cash compensation of income loss caused by illness.

This aspect of health insurance has interesting implications. We present here a simple model in which an individual's need to hedge against the risk of losing health interacts with her need to hedge against the risk of losing income due to (permanently) reduced health. This contrasts with discussions of health insurance in the literature, such as Zeckhauser (1970), Pauly (1971), and Zweifel and Breyer (1997), where only the risk of facing medical expenditures is discussed.[1] In the literature, the desire to restore health is, by and large, taken for granted and the discussion instead centres on whether or not the individual is fully insured against medical expenditures. This view has been contested recently by authors like Byrne and Thompson (2000) and Graboyes (2000), who argue that, when the probability of a successful treatment is small, the insuree may be better off with cash compensation if ill, rather than going through the treatment. In this paper, we take side with these authors in the view that cash compensation may be preferable. But rather than a low probability of a successful treatment, it is an individual's low productivity when healthy that makes her, in our analysis, prefer a health insurance with a cash-compensation component. Thus, we integrate what is often thought to be a 'typical' health insurance, a policy providing for medical treatment[2] (*i.e.*, medical insurance), and a disability insurance, a policy providing for compensation of income loss due to (permanent) reduced work ability. We consequently broaden the concept of health insurance in that we include not only a medical insurance but also a disability insurance, both of which insure against different consequences of the same risk, namely losing

[1] In fact, early writers like Arrow (1963), Zeckhauser (1970), and Pauly (1971) used the term *medical insurance* to describe what today in common parlance is called *health insurance*.

[2] For instance, reimbursing actual expenditures on medical treatment, or providing medical treatment directly (e.g. supplied by health personnel contracted with or employed by the insurance company).

health. In other words, we bundle the risk of facing medical expenditures and the risk of losing income, arguing that falling ill is the fundamental risk.[3]

Even though textbook discussions of health insurance seem to overlook the distinction between the two ways of compensating an ill insuree, many real-life health care systems do offer citizens a combination of treatment (*i.e.*, health care) and cash compensation (*i.e.*, disability payment). This is particularly prevalent in European countries, where health care and disability insurance are mostly publicly provided, or at least publicly regulated, with redistributional ambitions. In the US, a public health-insurance program (Medicaid) and a public disability-insurance scheme (social security disability insurance) are provided to low-income individuals. We show that this combination of medical treatment and cash compensation is not intrinsic to a public health-care system but would also grow out of a totally unregulated system.

In this paper, we are concerned with how the individual's choice among different insurance contracts, offering various degree of health restoration and cash compensation, depends on her ability to earn income, *i.e.*, her productivity. We develop our model in Section 2 and provide a preliminary analysis in Section 3. The individual's *ex ante* choice between the different types of insurance contracts is derived. Three types of contracts are available to the individual; a contract that indemnifies (i) medical expenditures, (ii) income loss due to reduced health, and (iii) a combination of the two. A key aspect of our model is that the cost of treatment is independent of the individual's ability, but rather depends on the fraction of health, and therefore the fraction of ability, that treatment restores. It is assumed that it is possible to fully recover from an illness if the individual receives the appropriate treatment.

Our main findings are derived in Section 4. We show that the individual buys different types of contracts depending on her ability when healthy. The intuition for our results is that the cost-benefit ratio of treatment is decreasing in the individual's ability if healthy. Hence, for a sufficiently high level of ability, the individual buys an insurance contract entitling her to complete restoration of health and no cash compensation if she falls ill, *i.e.*, a contract of type (i). On the other hand, for a sufficiently low level of ability when healthy, the individual buys a contract that provides her with some treatment

[3] An account of the literature on the economics of disability is in Haveman and Wolfe (2000). There is, however, little discussion in there of the present integrative approach to medical and disability insurance.

and some cash compensation if she falls ill, *i.e.*, a contract of type (iii). She consequently chooses not to fully restore health if ill, but rather to be partly compensated for the loss in income due to reduced health. Since both health and consumption are lower if ill, it follows that utility also is lower. In an unregulated insurance market, therefore, an individual with a sufficiently low level of ability will insure only partly. In Section 5, we consider a special case where the individual has Cobb-Douglas preferences. In a concluding Section 6, we discuss our results.

2 The model

Consider an individual who has preferences over consumption, c, and health, h. The individual faces exogenous uncertainty with respect to her state of health. She may either be healthy, which corresponds to state 1, or she may fall ill, which corresponds to state 2. The two states are mutually exclusive, jointly exhaustive, and verifiable. In state 1, the level of health is normalized to 1: $h_1 = 1$. In state 2, the individual is ill and suffers a complete loss in health. Health may, however, be restored (with certainty) if the individual receives medical treatment: t, where $0 \leq t \leq 1$. Thus, in state 2, the individual may have a level of health equal to 1 if she receives treatment at a level leading to complete recovery, *i.e.*, if $t = 1$. If no treatment is received, then $t = 0$, and health equals zero. Treatment leading to full recovery is available at cost C, while treatment leading to partial recovery is available at cost tC.[4] Health in the case of partial recovery is measured by the fraction of C that is spent on treatment: $h_2 = t$. Consumption in the two states are denoted c_1 and c_2, respectively.

The objective probability of falling ill is known to the individual and given by π, where $0 < \pi < 1$. The individual seeks to maximize the von Neumann-Morgenstern expected utility

$$(1 - \pi)u(c_1, 1) + \pi u(c_2, t),$$

where $u(c, h)$ is a Bernoulli utility function. We assume that $u : \Re^2_+ \to \Re$ is twice continuously differentiable and satisfies: $\forall (c, h) \in \Re^2_{++}$, $u_c > 0$, $u_h > 0$,

[4]The cost of curing an illness is assumed to depend on the characteristics of the illness, rather than the characteristics of the individual suffering from it. Thus, since all individuals face the same health risk, the cost of treatment is constant across individuals.

$u_{cc} < 0$, $u_{hh} < 0$ and $u_{ch} \geq 0$, where partial derivatives are denoted by subscripts. In particular, u is strictly concave implying that the individual is risk averse. Furthermore, $u_c(c,h) \to \infty$ as $c \downarrow 0$ whenever $h > 0$, and $u_h(c,h) \to \infty$ as $h \downarrow 0$ whenever $c > 0$. Finally, $u_c(c,h) \to \infty$ or $u_h(c,h) \to \infty$ as $c \downarrow 0$ and $h \downarrow 0$.

There exists a competitive insurance market in which profit maximizing insurers offer insurance at an actuarially fair premium. Information about the individual's probability of falling ill (π), which disease she is suffering from, and consequently, the associated costs of treatment, is symmetrically distributed among the market participants. Health status is verifiable, and insurance policies can be made contingent on it. The market for health insurance will, therefore, be efficient.

The individual is assumed to earn income according to her level of income-earning capacity, which we refer to as 'ability'. If healthy, the individual's ability is equal to A, while if ill and treated at a rate t, her ability equals tA. Ability is consequently proportional to health when ill. Note that the following analysis does *not* require insurance companies to know the individual's ability when healthy; hence A may be private information.

The risk-averse individual wishes to insure against the consequences of falling ill. Her insurance decision takes place *prior* to her knowing which state of the world has occurred. Since insurance is offered at an actuarially fair premium, the individual's budget constraint is given by:

$$(1-\pi)c_1 + \pi(c_2 + tC) = (1-\pi)A + \pi tA$$

where c_1 and $c_2 + tC$ are expenditures when healthy and ill, respectively, while A and tA are disposable income when healthy and ill, respectively. It is instructive in the context of the present paper to rearrange this budget constraint and write it as follows:

$$A - c_1 = \pi[tC + (c_2 - tA + A - c_1)]$$

where $(A - c_1)$ is the insurance premium, tC is the compensation in the form of medical treatment, and $(c_2 - tA + A - c_1)$ is the cash compensation.[5]

Make the following additional assumption on the utility function, u, namely that the marginal willingness to pay for health, u_h/u_c, is not higher if ill than if healthy, given that the expected cost of treatment is subtracted:

[5] Since the premium $A - c_1$ must be paid in both states, disposable income net of the premium equals $tA - (A - c_1)$ if no cash compensation is received. Hence, the cash compensation equals $c_2 - [tA - (A - c_1)]$.

$$\frac{u_h(tA - \pi tC, t)}{u_c(tA - \pi tC, t)} \leq \frac{u_h(A - \pi tC, 1)}{u_c(A - \pi tC, 1)}. \tag{1}$$

This assumption means that, for a fixed relative price of health in terms of consumption across states, the individual wants to shift the expected cost of treatment towards the healthy state if treatment does not lead to complete recovery (*i.e.*, if $t < 1$). A homothetic utility function satisfies this for any non-negative expected cost of treatment, but the assumption is also satisfied by other demand systems.

In the following, we analyze how the individual's insurance demand depends on her level of ability when healthy, A. In particular, we study how the decision on how to be compensated if ill depends on A: compensation in the form of health restoration (*i.e.*, treatment) and/or compensation of income loss (*i.e.*, cash). We also study how the extent of insurance coverage bought depends on A.

3 Preliminary analysis

As explained above, we assume that treatment leading to a health level t is available at a cost tC when ill. For the purpose of our analysis, however, let us be more general and ask what is the maximum utility achievable if the individual has to pay P (≥ 0) for the treatment t:

$$\begin{aligned} U(t, P, A) &:= \max_{(c_1, c_2)} \{(1 - \pi)u(c_1, 1) + \pi u(c_2, t)\} \\ &\text{subject to } (1 - \pi)c_1 + \pi(c_2 + P) = (1 - \pi)A + \pi tA, \end{aligned}$$

where $U : \Re_{++} \times [0, (1/\pi - (1 - t))A) \times \Re_{++} \to \Re$. The individual is offered a positive level of treatment, t, that may, for the purpose of defining and analyzing the U function, exceed one. The maximum price she is able to pay for this level of t is given by $[1/\pi - (1 - t)]\, A$. The price of treatment, P, will thus be somewhere between zero and this maximum price. Naturally, the higher the level of ability when healthy, A, the higher the price the individual can pay for treatment. Moreover, the higher the probability of falling ill, the less the individual is able to pay for treatment.

To investigate the optimization problem, form the corresponding Lagrangian:

$$\begin{aligned}\mathcal{L}(c_1, c_2, \lambda; t, P, A) &= (1-\pi)u(c_1, 1) + \pi u(c_2, t) \\ &+ \lambda[(1-(1-t)\pi)A - (1-\pi)c_1 - \pi(c_2+P)].\end{aligned}$$

Given our assumptions on u, the first-order necessary conditions (FOCs) give the consumption demand function in each of the two states of the world:

$$(\mathbf{c}_1(t, P, A), \mathbf{c}_2(t, P, A)) \in \Re^2_{++} ,$$

satisfying

$$u_c(\mathbf{c}_1(t, P, A), 1) = u_c(\mathbf{c}_2(t, P, A), t) = \lambda \tag{2}$$

and the budget constraint. Optimal consumption in each of the two states of the world is a function of treatment (*i.e.*, the degree of recovery in state 2), price of treatment (P), and income (A), as shown above. Equation (2) follows from the FOCs and implies that, in optimum, the individual's marginal utility of consumption is equal in the two states.

The indirect utility function U can now be written:

$$U(t, P, A) = (1-\pi)u(\mathbf{c}_1(t, P, A), 1) + \pi u(\mathbf{c}_2(t, P, A), t) .$$

We have that U is strictly increasing in t, strictly decreasing in P, and strictly increasing in A. Hence, we can define an indifference curve in (t, P)–space going through $(\bar{t}, \bar{P})$, call it $P(t, A; \bar{t}, \bar{P})$, by $U(t, P, A)$ being equal to $U(\bar{t}, \bar{P}, A)$ if and only if $P = P(t, A; \bar{t}, \bar{P})$. It follows that $P(t, A; \bar{t}, \bar{P})$ is increasing in both t and A. Furthermore,

$$\frac{\partial P(t, A; \bar{t}, \bar{P})}{\partial t} = -\frac{\frac{\partial U}{\partial t}}{\frac{\partial U}{\partial P}} = -\frac{\frac{\partial \mathcal{L}}{\partial t}}{\frac{\partial L}{\partial P}} = \frac{\pi(u_h(c_2, t) + \lambda A)}{\pi\lambda} = \frac{u_h(c_2, t)}{u_c(c_2, t)} + A ,$$

where the second equality follows from the envelope theorem, and the fourth equality is implied by eq. (2). This means that the willingness to pay for treatment is equal to the willingness to pay for health plus the additional income-earning capacity generated by treatment. Since, by construction, $P(t, A; \bar{t}, \bar{P})$ is the indifference curve going through $(\bar{t}, \bar{P})$, it follows that

$$\frac{\partial P(\bar{t}, A; \bar{t}, \bar{P})}{\partial A} = 0 . \tag{3}$$

Moreover, since $u_{cc} < 0$, $u_{ch} \geq 0$ and $\partial\mathbf{c}_2/\partial A > 0$, then eq. (3) implies that

$$\frac{\partial P(\bar{t}, A; \bar{t}, \bar{P})}{\partial t \partial A} = \frac{\partial}{\partial A}\left[\frac{u_h(\mathbf{c}_2(\bar{t}, \bar{P}, A), \bar{t})}{u_c(\mathbf{c}_2(\bar{t}, \bar{P}, A), \bar{t})} + A\right] > 1.$$

Hence, the slope of an indifference curve through any point $(\bar{t}, \bar{P})$ increases with ability A. We will refer to this as the *single-crossing property.* The single-crossing property is illustrated in Figure 1 for two different values of ability, $A_l < A_h$, where l and h denote low and high ability, respectively.

It remains to be shown that $P(t, A; \bar{t}, \bar{P})$ is a strictly concave function of t, so that an individual being faced with the possibility of purchasing treatment t at cost $P = tC$ constrained by $t \leq 1$, will have a unique level of treatment maximizing $U(t, tC, A)$. This will be shown by demonstrating that, if $(t^{'}, P^{'})$ and $(t^{''}, P^{''})$ are different combinations yielding the same utility level given A, then any interior convex combination

$$(t, P) = (\alpha t' + (1-\alpha)t'', \alpha P' + (1-\alpha)P''), \quad 0 < \alpha < 1,$$

will yield a strictly higher utility level. Hence, assume that $U(t', P', A) = U(t'', P'', A) = U(\bar{t}, \bar{P}, A)$, and introduce some notation:

$$\begin{array}{ll} c_1' = \mathbf{c}_1(t', P', A) & c_1'' = \mathbf{c}_1(t'', P'', A) \\ c_2' = \mathbf{c}_2(t', P', A) & c_2'' = \mathbf{c}_2(t'', P'', A). \end{array}$$

Also, let $(c_1, c_2) = (\alpha c_1' + (1-\alpha)c_1'', \alpha c_2' + (1-\alpha)c_2'')$. Since (c_1', c_2') satisfies the budget constraint given (t', P', A), and (c_1'', c_2'') satisfies the budget constraint given (t'', P'', A), it follows that (c_1, c_2) satisfies the budget constraint given (t, P, A), implying that (c_1, c_2) is feasible. Hence,

$$\begin{array}{rcl} U(t, P, A) & \geq & \pi u(c_1, A) + (1-\pi)u(c_2, tA) \\ & > & \pi[\alpha u(c_1', A) + (1-\alpha)u(c_1'', A)] \\ & & +\, (1-\pi)[\alpha u(c_2', t'A) + (1-\alpha)u(c_2'', t''A)] \\ & = & \pi U(t', P', A) + (1-\pi)U(t'', P'', A) = U(\bar{t}, \bar{P}, A) \end{array}$$

where the first inequality follows since (c_1, c_2) is feasible, and the second equality follows since u is strictly concave. This means that $P(t, A; \bar{t}, \bar{P})$ is a strictly concave function of t; we will refer to this property as *diminishing willingness to pay for treatment.*

4 Main result

Due to the diminishing willingness to pay for treatment, an individual being faced with the possibility of purchasing treatment t at cost $P = tC$, constrained by $t \leq 1$, will have a unique level of treatment $\mathbf{t}(A)$ maximizing $U(t, tC, A)$. Furthermore, due to the single-crossing property, $\mathbf{t}(A)$ will (weakly) increase with A. In fact, whenever $0 < \mathbf{t}(A) < 1$, $\mathbf{t}(A)$ is determined by

$$\frac{\partial P(\mathbf{t}(A), A; \mathbf{t}(A), \mathbf{t}(A)C)}{\partial t} = C.$$

I.e., the marginal willingness to pay for treatment equals the marginal cost of treatment. It follows that $\mathbf{t}(A)$ is a strictly increasing function of A when $0 < \mathbf{t}(A) < 1$.

We have that $\mathbf{t}(A) = 1$ for all $A \geq A^*$, where A^* satisfies that the indifference curve through $(1, C)$ has slope C, so that unconstrained maximization of $U(t, tC, A^*)$ leads to $t = 1$. By the single-crossing property, A^* is unique. Hence, we can define A^* by

$$\frac{\partial P(1, A^*; 1, C)}{\partial t} = C\,.$$

Since $\partial P(t, A; \bar{t}, \bar{P})/\partial t > A$ for all values of t, $\bar{t}$, and $\bar{P}$, we have that $A^* < C$. Moreover, it follows from eq. (2) that $c_1 = c_2 = A - \pi C$ when $t = 1$ and $P = C$, implying that $t = 1$ is not feasible when $A < \pi C$. Finally, since $u_c(c, h) \to \infty$ as $c \downarrow 0$ whenever $h > 0$, it follows that $\partial P(1, A; 1, C)/\partial t \to 0$ as $A \downarrow \pi C$. This means that $A^* > \pi C$. Note that the individual may choose a level of treatment that enables her to fully recover (*i.e.*, $h_2 = h_1$) even if $A < C$, provided that A is greater than or equal to the insurance premium. The individual's optimal level of treatment is illustrated in Figure 2, for two different values of ability: $A_l < A^*$ and $A_h = A^*$, where l and h denotes low and high ability, respectively.

These observations partially prove the proposition below, where we apply the following terminology: By *full insurance,* we mean that $u(c_1, h_1) = u(c_2, h_2)$, *i.e.*, that utility is constant across the two states. By *partial insurance,* we mean that $u(c_1, h_1) > u(c_2, h_2)$, *i.e.*, that utility is lower when the individual is ill, even though she receives the insurance indemnity. The proposition shows that the individual is fully insured if she chooses full treatment, while only partly insured if she chooses partial treatment. Moreover, with full treatment, she will not receive any cash payment in addition to what is required to pay for the treatment, while in the case of partial treatment, her indemnity will exceed the amount used for medical treatment.

Proposition 1 *There exists a level of ability, A^*, where $\pi C < A^* < C$, such that the following holds:*

1. *If the individual's level of ability when healthy, A, is equal to or greater than the critical value A^* (i.e., $A \geq A^*$), then her optimal level of treatment is equal to one and does not vary with A: $\mathbf{t}(A) = 1$. Her level of consumption is the same in both states: $\mathbf{c}_1(1, C, A) = \mathbf{c}_2(1, C, A) = A - \pi C$. Utility is the same in both states: $u(c_1, h_1) = u(c_2, h_2)$; thus, the individual is fully insured. Her insurance coverage is in the form of medical treatment only.*

2. *If, however, the individual's level of ability when healthy, A, is less than the critical value A^* (i.e., $0 < A < A^*$), then her optimal level of treatment is positive and less than one, $0 < \mathbf{t}(A) < 1$, and increasing with A: $\partial \mathbf{t}(A)/\partial A > 0$. Her level of consumption if ill is lower than if healthy: $\mathbf{c}_2(\mathbf{t}(A), \mathbf{t}(A)C, A) < \mathbf{c}_1(\mathbf{t}(A), \mathbf{t}(A)C, A)$. Her utility if ill is lower than if healthy: $u(c_2, h_2) < u(c_1, h_1)$; thus, she is partly insured. Her insurance coverage is partly in the form of medical treatment and partly in the form of cash.*

Proof. Part (1). Given the observations prior to the Proposition, it remains to be shown that the individual is fully insured and has insurance coverage in the form of medical treatment only. Full insurance follows since $c_1 = c_2 = A - \pi C$ and $h_1 = h_2 = 1$, implying that $u(c_1, h_1) = u(c_2, h_2)$. Since cash payment equals $c_2 - tA + A - c_1$ (cf. footnote 5), it follows that cash payment is zero.

Part (2). By the definition of A^*, $0 \leq \mathbf{t}(A) < 1$ whenever $0 < A < A^*$. Moreover, since $u_h(c, h) \to \infty$ as $h \downarrow 0$ whenever $c > 0$, and $u_c(c, h) \to \infty$ or $u_h(c, h) \to \infty$ as $c \downarrow 0$ and $h \downarrow 0$, it follows from $A > 0$ and eq. (2) that $\partial P(t, A; t, tC)/\partial t > C$ if t is sufficiently small; hence, $\mathbf{t}(A) > 0$. Now, the single-crossing property implies that $d\mathbf{t}(A)/dA > 0$. From eq. (2) and the properties of u, it follows that $c_1 > c_2$, since $h_1 = 1$, and $h_2 = \mathbf{t}(A) < 1$. This in turn means that $u(c_1, h_1) > u(c_2, h_2)$, showing that the individual is partly insured. To show that cash payment is positive, *i.e.*, that $c_2 - tA + A - c_1 > 0$, we start out with the condition that $\mathbf{t}(A)$ is determined by $\partial P(\mathbf{t}(A), A; \mathbf{t}(A), \mathbf{t}(A)C)/\partial t = C$ whenever $0 < \mathbf{t}(A) < 1$. Thus, when ill, the marginal willingness to pay for treatment equals the cost of treatment: $u_h(c_2, t)/u_c(c_2, t) + A = C$. In the hypothetical case where treatment were available also if healthy, or inversely, where health could be sold at price $C - A$, the access to actuarially fair insurance would imply the same level of health in both states. Since this is not the case, it is a binding constraint that health if healthy cannot be sold at price $C - A$, implying that marginal willingness to pay for health if healthy is less than $C - A$: $u_h(c_1, 1)/u_c(c_1, 1) < C + A = u_h(c_2, t)/u_c(c_2, t)$. Hence, effectively, the relative price of health in terms of consumption is lower if healthy than if ill. Combining this finding with the budget constraint and the assumption (1), and recalling that $u_{cc} < 0$ and $u_{ch} \geq 0$, imply that $c_1 < A - \pi t C$ and $c_2 > tA - \pi t C$. This in turn means that $c_1 - A < c_2 - tA$, or $c_2 - tA + A - c_1 > 0$. ■

5 A special case

The following Cobb-Douglas function is a Bernoulli function that satisfies all assumptions listed in Section 2:

$$u(c, h) = c^r h^s, \text{ with } \quad r > 0,\ s > 0 \text{ and } r + s < 1\,.$$

With this function, it is possible explicitly to calculate A^*. We have that

$$\begin{aligned}\tfrac{\partial P(1,A;1,C)}{\partial t} &= \tfrac{u_h(c_2,1)}{u_c(c_2,1)} + A \\ &= \tfrac{u_h(A-\pi C,1)}{u_c(A-\pi C,1)} + A = \tfrac{s}{r}(A - \pi C) + A\,,\end{aligned}$$

where the second equality follows since $c_2 = A - \pi C$ when $t = 1$ and $P = C$, and the third equality follows since

$$\frac{u_h(c, h)}{u_c(c, h)} = \frac{s}{r} \cdot \frac{c}{h}$$

when u is given by the Cobb-Douglas function above. Since A^* is defined by $\partial P(1, A^*; 1, C)/\partial t = C$, we can find A^* by solving

$$\frac{s}{r}(A^* - \pi C) + A^* = C,$$

which implies that

$$A^* = \frac{r + \pi s}{r + s} C \,.$$

Thus, A^* is increasing in the probability of falling ill, π, and in the cost of treatment, C.

6 Discussion

Our focus of attention has been on how an individual's inherent ability at full functionality (*i.e.*, when healthy) influences her *ex ante* choice of insurance contract and her optimal level of coverage. Insurance allows the individual to allocate income between the two states of the world prior to knowing which state has occurred. Moreover, it enables her to achieve her optimal distribution of income on consumption and health when ill. Since the individual is assumed to have perfect foresight, her optimal allocation *ex ante* will be optimal also *ex post*.

The novelty of this paper is the integration of what is usually thought to be different types of insurance, namely insurance against the risk of incurring medical expenditures and insurance against the risk of losing income due to (permanently) reduced ability (or, productivity). We argue that a health insurance should offer a hedge against both potential expenditures on medical treatments and a potential loss in income due to reduced health. Contrary to what is assumed in most of the health insurance literature, we allow the individual to choose whether or not to restore health if ill. We focus on how the individual's ability at full functionality determines to what extent she choose to restore health if she falls ill. We show that if the individual's level of ability is sufficiently low, then she chooses to restore health only partly, thus suffering a loss in ability. Moreover, in order to obtain the preferred level of consumption when ill, she holds a contract that entitles her to a cash transfer in the event of illness. Consequently, a low-ability individual chooses a contract that ensures her some cash payment and some medical treatment.[6] If, on the other hand, the individual has a sufficiently high level of ability when healthy, then she will hold a contract that provides for

[6] It is assumed that ability if ill is zero without any treatment. If we allow this ability level to be positive, then an individual with low ability when healthy may choose not to receive treatment at all.

complete medical treatment and thus full restoration of health. It should be noted that, whether the actual compensation is in the form of a cash transfer that covers the actual costs of treatment, or is directly in the form of medical treatment, is of no importance. The individual's *ex-ante* decision to restore health is unaffected by the way she is compensated; the fundamental decision is whether to restore health or not.[7]

Our findings are driven by the fact that the potential loss in income, *i.e.*, ability, is larger, the higher is the ability at full functionality. This implies that the 'net-price' of the two types of contracts differs depending on the individual's ability. The higher the potential income loss due to reduced ability (*i.e.*, health), the relatively cheaper is the contract offering indemnity in kind (*i.e.*, treatment), compared to a contract offering cash compensation of income loss. Thus, the cost-benefit ratio on medical treatment is lower the higher the level of ability at full functionality.

The preceding analysis is based on a highly stylized model. We largely disregard any informational constraints causing the familiar problems of adverse selection and moral hazard. Furthermore, the individual is assumed to *ex ante* be fully informed about health consequences of illnesses as well as about treatment options (*i.e.*, consumer sovereignty). The insurers need not, however, know the individual's ability at full functionality, since it turns out that, even without such knowledge, first-best, zero-profit insurance contracts lead in an undistorted way to self-selection. Transaction costs associated with gathering of information about relevant treatment options and treatment costs for all types of diseases are ignored. Moreover, we make a somewhat strong assumption regarding the treatment technology: the individual recovers instantly and proportionally to the level of treatment received, and treatment is effective with respect to health. However, taking these limitations into account, we still think our model provides rather interesting findings which may be subject to further studies.

[7] Arrow (1963) mentions three different ways in which costs of medical care can be covered in an insurance contract: payment directly in medical services, a fixed cash payment, and a cash payment that covers the actual costs involved in providing the necessary medical treatment. In a perfect market, individuals wishing to receive medical treatment would be indifferent between a payment directly in the form of medical treatment and its cash equivalent.

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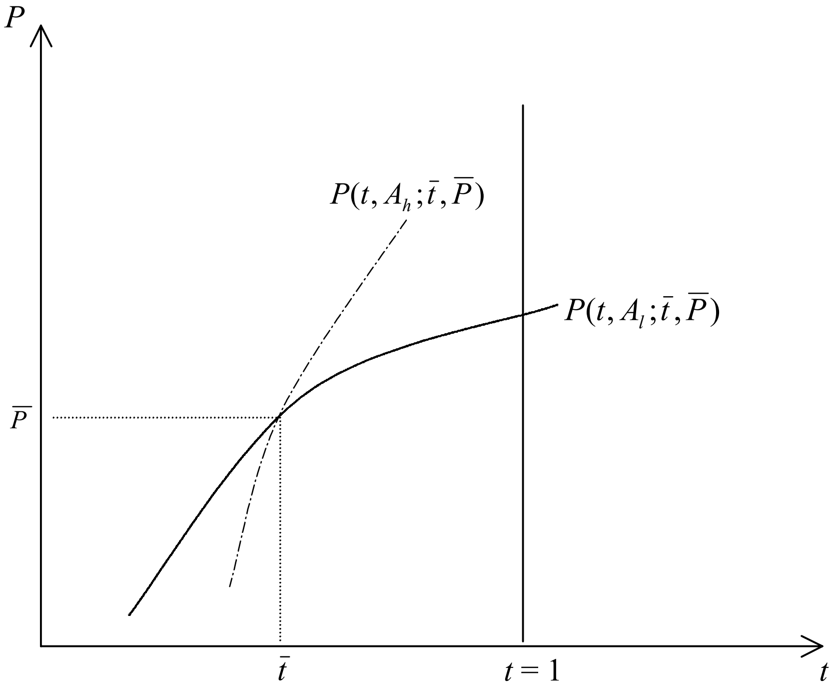

Figure 1. The single-crossing property.

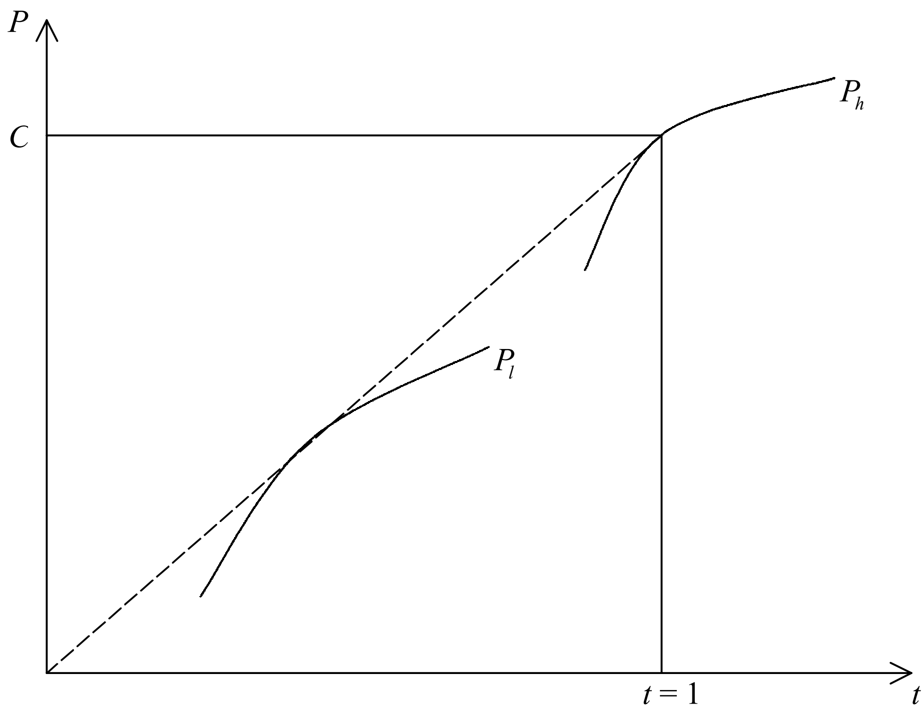

Figure 2. The optimal level of treatment.