Role of Healthy Lifestyle on Individual Decision Making for Disease Prevention.

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This paper analyzes the impact of lifestyle choices on the likelihood of future illness and discusses the role of private insurance markets on individual behavior. Using a state-preference model under uncertainty we find the optimal level of investment in preventive behavior that mitigates the risk of disease onset in future. Our model also explores what conditions are necessary for lifestyle choices and insurance to be complementary tools in reducing disease risk and future financial burden. In the presence of perfect capital market (when individual can trade consumption between periods), we show that agents can self-insure and hence have no need for market insurance to mitigate the financial consequence of disease onset in the future. Finally, we examine consequences of moral hazard problem of private insurance market on preventive health promotion.

Keywords: uncertainty, healthy lifestyle, investment in health.

Introduction

Lifestyle can often affect an individual's predilection towards future illness.[1] Nonetheless a significant proportion of people fail to adhere to a healthy lifestyle. For example, obesity is a major risk factor for premature mortality, cardiovascular disease, type 2 diabettis mellitus, osteoarthritis, certain cancers and other medical conditions, yet recent estimate indicate that two out of three US adults are overweight or obese (Manson and Bassuk, 2003 and CDC). In this paper we explore individual investment in healthy behavior that lowers the likelihood of future ill health.

Ill health has two effects. First, people lose utility. Even if income is enhanced so consumption after paying for medical care is the same, most people would consider their "state of happiness" as lower than if the ill health did not occur. But most people suffer some financial consequences as well. Income may fall, and even if it does not, there are the costs of treatment. Insurance can mitigate the financial consequences, but unless a swift and comprehensive cure exists for the disease, the utility effect may remain. Thus, a second purpose of this paper is to explore to what extent and under what conditions healthy lifestyle and insurance are substitutes or complements. In this context we also examine the effect of moral hazard on self-protecting activities as consequence of private insurance market.

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[1] It has been well documented that for cardiovascular disease, some types of cancers, health related problems due to obesity (Must et al. 1999), and Alzheimer's Disease(AD) (Pope et al. 2003) healthy lifestyle choices play an important role in lowering risk of disease incident.

We use a state-preference model of behavior under uncertainty that incorporates individual decision making about healthy lifestyles to mitigate the probability of having a disease in the future. We then add the possibility of insurance that lowers the financial risk of getting sick to see the extent to which lifestyle spending (self-protection) is a substitute for market insurance against the financial consequences, but not the utility consequences, of future disease onset. This allows us to see under what conditions lifestyle and insurance may coexist. Using the results from a model of individual decision-making, we explore optimal policy intervention that relieves the financial burden of disease, and study what effect this has on individual investments in health.

The paper is organized as follows. The next section provides a more in-depth discussion of the existing literature on uncertainty in lifetime behavior of health investment. After that we provide a conceptual model of behavior and risk and explore the role of insurance and the effects private insurance market on individual prevention efforts. We close the paper with conclusions and suggestions for future research.

Literature Review.

Lifestyle is one way people can invest in health or human capital. The literature exploring health as an investment in human capital started with Grossman (1972). In his model health serves as human capital, which improves both labor market and non-labor market productivity. Hence, health is considered as both an investment and consumption good. The analysis of human capital theory shows how individuals invest in health to produce the output of "healthy days" and optimal amount of investment in human capital is determined by the relative costs and benefits, where the costs occur in short-term and benefits accrue in the future.

Cropper (1977) adds uncertainty to the Grossman framework. She formulates a life-cycle model for investment in health, which assumes that individuals invest in health to avoid the disutility associated with being ill. Uncertainty is introduced through randomly occurring illness, the likelihood of which depends on an individual's exposure to germs and viruses and size of his or her stock of health. Because illness has no permanent or long-term consequences in her model, Cropper acknowledges that it is best suited for mild illness such as colds, viruses and influenza, and it may not be appropriate for analyzing severe or major illness.

Liljas (1998) also studies health investment model under uncertainty and examines how the optimal level of investment in health changes when the depreciation of health capital depends upon the level of health. In his model health capital provides direct utility. Lijas then uses this model to analyze the role of insurance and how it affects the optimum stock of health capital.

Muurinen (1982) examines health investment model when the depreciation of health depends upon age and other environmental factors. He then focuses the comparative static results of effects of education, age and wealth o n health.

Two other studies that investigate individual investment in health under uncertainty focus on health as a hedge against financial loss. Picone et. al. (1998) looks at the effect of uncertainty about the incidence of illness on the precautionary behavior of individuals in their retirement age. He finds that in to the face of greater uncertainty people adjust their precautionary behavior by investing to increase their stock of health capital. Chang (1996) uses a two-period version of Grossman's pure investment model where the source of uncertainty are shocks to the income generating function which, in turn, depends on the health production function. Health again becomes a hedge against future income loss.

Health is only one way people hedge against future illness. Another is insurance, which will often change how people invest in health (Courbage et al, 2004). In the seminal paper, Ehrlich and Becker (1972) discuss the interaction between the market insurance and prevention activities. They find that market insurance and *self-insurance* are substitutes but the market insurance and *self-protection* can be complements depending on the level of probability of loss. Courbage (2004) also examines this interaction under the Yarri's Dual Theory of Choice and confirms Ehrlich and Becker's findings.

"Moral hazard" is an inevitable consequence of market insurance that alters individual behavior on self-protecting activities. Pauly (1968) shows that moral hazard problem can be partly reduced by offering the insurance policy with deductibles or coinsurance. Shavell(1979) explains the moral hazard problem of private insurance market and proposes the optimal insurance policy as partial solution to this problem.

A model of behavior and health risk.

Assume a simple two period endowment economy where each period the agent is endowed with a fixed quantity of good with no possibility of borrowing or lending across periods. In the first period the agent can consume the good, yielding utility, or spend some of it on "healthy lifestyle" (risk-mitigating spending), which yields no utility but reduces the probability of getting sick in the second period. In the second period the agent is either healthy or sick. If healthy she gets the full utility from consuming the endowment. If sick she faces two losses. First, some of the endowment is spent to mitigate the effects of being sick – for example, on palliative or curative medical care. In addition, we assume the individuals basic level of utility is diminished just by being sick. In essence, this means that in addition to the direct medical care costs there is also utility loss the individual will suffer when get sick in the second period. The probability of getting sick in period two depends on how much risk mitigating spending takes place in period 1. Thus, the agent chooses risk mitigating spending in period 1 to maximize expected utility

$$U[C_1(1-h)]+\beta p(h)U(C_2)+\beta(1-p(h))\{(1-v_1)U(C_2(1-v_2))\} \qquad (1)$$

where C_1 is the first period consumption, h ($0 \leq h \leq 1$) is the share of C_1 spent on health development (lifestyle or risk-mitigating spending), C_2 is second period consumption, v_1 ($0<v_1<1$)is the diminished capacity of the agent to enjoy consumption if sick (a non-consumption utility loss) and v_2 ($0<v_2<1$)is the financial cost of being sick measured in terms of lost consumption possibility, for example the cost of care. These strict inequalities indicate that there is always some cost and utility consequences of getting sick, but never is the consequence all-consuming of the endowment. The probability of not getting sick, p(h) depends on the amount invested in risk-mitigating behavior, which can vary from 0 to the full amount of endowment in period 1, with $p'(h)>0$ and $p''(h)<0$. β is the time rate of preference ($0<\beta<1$). Utility, U(•), in each period comes from the (non-health related) consumption with $U(0)=0$, $U(C_i)<\infty$, $U'>0$ and $U''<0$ over the range $[0,C_i]$ for i=1,2.

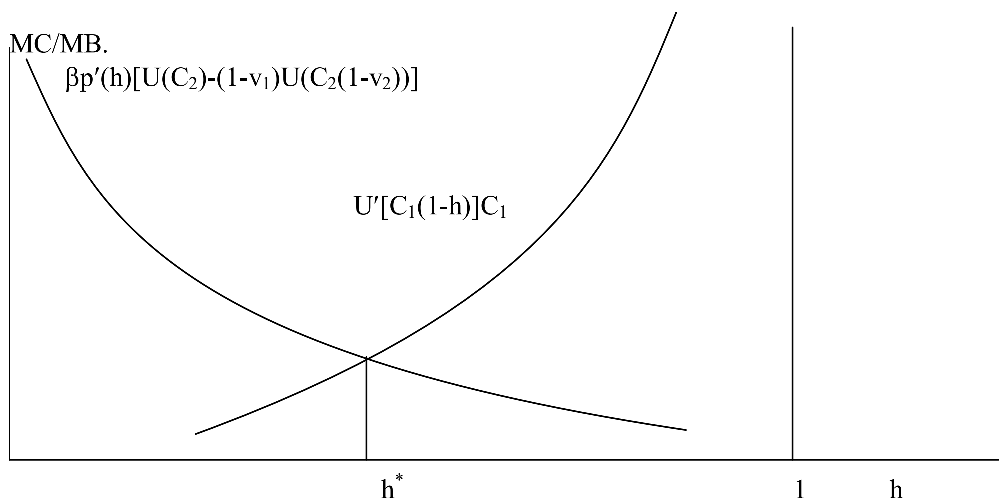
Maximizing (1) with respect to h gives the first order necessary condition

$-U'[C_1(1-h)]C_1 + \beta p'(h)[U(C_2) - (1-v_1)U(C_2(1-v_2))] = 0$ thus

$$U'[C_1(1-h)]C_1 = \beta p'(h)[U(C_2) - (1-v_1)U(C_2(1-v_2))] \qquad (2)$$

which implies that the agent maximizes expected utility when the marginal cost of spending on h (investing in health in the first period) equals the expected marginal benefit from lowering the probability of getting the disease in second period. The optimal level of h that maximizes the expected utility is shown graphically in figure1.

FIGURE 1.



The optimal level of h is found from the intersection between the marginal benefit and marginal cost (of investing in healthy life style) curves. The marginal benefit curve for h, given by $\beta p'(h)[U(C_2)-(1-v_1)U(C_2(1-v_2))]$, slopes downward because of diminishing marginal return on health investment in terms of the probability of getting sick ($p''(h)<0$), while the marginal cost curve, $U'[C_1(1-h)]C_1$ slopes upward because of diminishing marginal utility of consumption. Increasing h lowers net consumption in period 1, and thus the marginal cost of investing in health increases, as h gets larger.

Comparative static analysis:

Comparative static analysis allows us to see how optimal h, h*, responds to changes in income or the model parameters. Given that both utility and marginal utility are positive, from figure 1 it is clear that an increase in v_1 or v_2 will increase first period spending on h, since higher values in either of these parameters shifts the marginal benefit curve of investing in h (the downward sloping curve in figure 1) upward. The individual offsets the greater expected loss from the disease by taking more preventive measures. A higher time preference (meaning a lower value for β) lowers spending on h. Finally, increases in the endowment have both income and substitution effects so the impact on h is uncertain. Looking at C_1 we note that an increase will both decrease the marginal utility term, $U'(C_1(1-h))$ by diminishing marginal utility, and increase the level term, C_1, in the marginal cost of h (the upward sloping curve in figure 1). Thus the net shift in that curve is uncertain. Likewise, the change in h from a change in C2 in uncertain. We can see this by comparing $\beta p'(h)[U(C_2)-(1-v_1)U(C_2(1-v_2))]$ to $\beta p'(h)[U(C_2+k)-(1-v_1)U((C_2+k)(1-v_2))]$ and seeing if the marginal benefit curve shifts unequivocally up or unequivocally down. Ignore $\beta p'(h)$ and compare these two statements term by term. We note that $C_2+k-C_2=k>[(C_2+k)(1-v_2)]-[(C_2)(1-v_2)]=k(1-v_2)$ so the change in the argument of the first term (by adding k to C2) exceeds the change in the argument of the second term. This is sufficient to tell us that the shift in the marginal benefit curve of h (the downward sloping curve in figure 1) is uncertain, and thus so is the change in h. It will depend on both the level of C_2 and the value of v_2.[2]

Market Insurance.

Our model so far discussed *self-protection*, that is, actions that reduce the probability of an adverse outcome in the future, which is one type of prevention activity individuals can take. The other is to purchase insurance against an adverse outcome in the second period. Insurance reduces the severity of financial loss if an individual gets sick in the second period. Self-insuriance occurs when an individual establishes reserves for possible future losses. In our model there is no ability to transfer C_1 to C_2 thus not allowing self-insurance[3]. We now, however, add the possibility of individuals purchasing market-based insurance against getting sick in period two.

Market for insurance mitigates the financial, but not physical, impacts of the disease. We assume insurance pays a subsidy which offsets part or all of the financial costs of the disease in the second period, but pays only if the individual gets sick.

Assume an individual can pay a share of C_1 as an insurance premium to receive benefits in period 2 if sick. Since it is denominated as a share of C_1 the premium *I* is

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[2] We note that if buying health cost an absolute amount of C_1 rather than a share of C_1 and the cost of ill health in period two was likewise absolute rather than proportional there would be only an income effect. In this case, increases in C_1 would unequivocally increase h and increases in C_2 would unequivocally decrease h.

[3] We will change the assumptions of the model to allow self-insurance in a later section of this paper.

constrained between 0 and 1, that is, $0 \le I \le 1$. If the individual buys the insurance and gets the disease the insurance pays an incremental benefit as a share of C_2, that is, the benefit is BC_2. Otherwise, the payment is 0. Thus a payment of IC_1 as insurance premium in the first period has an expected payoff of BC_2 in the second period, making expected utility

$$U[C_1(1-I-h)]+\beta[p(h)U(C_2)+(1-p(h))(1-v_1)U[C_2(1-v_2+B)] \qquad (3)$$

where we assume B is exogenous and require that $0 \le h \le 1$, $0 \le I \le 1$ and $h+I<1$ so the total share of C_1 allocated to preventive behavior and insurance is strictly less than the endowment. We also assume that $C_1 I = C_2 (1-p(h)) B$ which implies that the insurance is actuarially fair and the agent knows it. For interior solution for both h and I we assume that h and I are both normal goods. Our agent maximizes expected utility with respect to the insurance fair market condition in the choice of I and h.

The first order condition with respect to I is

$$-U'[C_1(1-h-I)]C_1+\lambda C_1=0 \qquad (4)$$

where λ is the lagrangian multiplier on the constraint. The first order condition with respect to h is

$$-U'[C_1(1-h-I)]C_1+\beta p'(h)[U(C_2)-(1-v_1)\{U(C_2(1-v_2+B)\}]+\lambda p'(h)BC_2=0 \qquad (5)$$

Finally the first-order condition with respect to λ is

$$C_1 I - C_2 (1-p(h)) B=0. \qquad (6)$$

By rearranging (4) we have

$\lambda = U'[C_1(1-h-I)]$ and from (6)

$$B=\frac{C_1 I}{C_2(1-p(h))}. \qquad (7)$$

Rearranging (5) and substituting in these values we have

$$U'[C_1(1-h-I)]C_1 = \beta p'(h)[U(C_2)-(1-v_1)\{U(C_2(1-v_2+B)\}]+U'[C_1(1-h-I)]C_1\frac{p'(h)I}{1-p(h)}$$

or

$$U'[C_1(1-h-I)]C_1(1-\frac{p'(h)I}{1-p(h)}) = \beta p'(h)[U(C_2)-(1-v_1)U[C_2(1-v_2)+\frac{C_1 I}{1-p(h)}]. \qquad (8)$$

Notice if I=0 this is the same as (2). However, when I>0 the marginal benefit of h, given by the right hand side of (8), is clearly smaller than the right hand side of (2), and the marginal benefit curve shifts down. The effect of positive I on the marginal cost of h, given by the left hand side of (8) is, however, less clear. Clearly when I>0 for every value of h the marginal utility term is larger from diminishing marginal utility, but it is multiplied by something less than 1 so the overall effect on this side of equation (8) seems uncertain. Thus, adding insurance seems to have an indeterminate effect on h.

An appeal to the constraint that the insurance premium be actuarially fair provides further insight. Notice from equation (7) that for a given positive B, C_1 and C_2 there is an inverse relationship between I and h. Adding to this the fact that having insurance available makes investing in h less compelling, and we would expect that adding insurance in the market allows agents to substitute it for some investment in health, and we would expect h to fall. But as we noted in the paragraph above, this is not a certain outcome.

Earlier studies, found that market insurance and self-protection could be complements, i.e. existence of market insurance can increase the demand for self-protection. In the seminal paper of Ehrlich and Becker (1972), market insurance and self-protection are shown to be complements under the expected utility theory. Curbage(2004) also find the same relationship between the market insurance and self-protection under Dual theory. But both studies examine this interaction within a single period model.

Market Insurance, Self-protection and Moral hazard.

Market insurance redistributes income towards the hazardous state while the self-protection reduces the probability of the state. Here moral hazard is the effect of market insurance on the individual incentives of spending on healthy behavior (self-protection). Therefore, one reason of lower spending on healthy lifestyle behavior is the moral hazard. So moral hazard alters individual's self-protecting behavior. It is obvious that the lower out-of-pocket-expenditure for medical care (because of insurance) will change individual lifestyle behavior because insurance provides protection against future financial loss. Market insurance discourages spending on self –protection by lowering the marginal benefit of spending on healthy behavior[3]. When the insurance premium is not dependent to the choice of health risk behavior, there may be negative effect on self-protecting preventive activities by an individual.

According to Arrow (1962), the desired solution in case of market insurance (in presence of moral hazard) is to separate individual control on the event against which he/she is insured. But this separation is not possible for individual incentives for prevention activities. Two partial solution of moral hazard are discussed in economics: incomplete coverage against loss and "monitoring" by the insurer for the prevention care taken to prevent loss. Incomplete coverage gives an individual motive to prevent loss because of possibility of financial loss in future.

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3. comparing right hand sides of equation 2 and equation 8.

We consider partial solution of moral hazard with incomplete coverage. It is realistic to assume that observation of care by the insurer is either impossible or too costly to perform. The underlying assumption in case of "incomplete coverage" is that possibility of lowering the coverage level will subject the insured to the risk and thereby create incentives to take preventive measures. We assume the expected profit (for insurance company) for offering the insurance is zero, i.e. insurance policy is a "break-even" policy. Our objective is to examine the optimal break-even policy under moral hazard when the coverage is incomplete. In our model incomplete coverage means $B<v_2$, where B is the coverage or benefit the individual gets if sick and v_2 is the financial loss the individual faces if get sick.

So for positive I, marginal benefit of investing on healthy behavior is less although the marginal cost (LHS of 8) of investing in health is uncertain, making the final outcome of h uncertain. It is intuitive to see that moral hazard drives individuals to spend less on preventive behavior (inverse relationship between the market insurance and h from equation 6). We assume that insurer offers insurance at fair market price, so optimal policy under moral hazard will also satisfy the condition that $C_1I=C_2(1-p(h))B$. If individual spends less on healthy behavior, h (because of moral hazard) then h will be less so as p(h). Assuming positive and given C_1, C_2 and B, right hand side of the constraint increases and to satisfy the break-even insurance policy, *I* (premium) should increase. This means that individual substitutes h towards *I*, so h will fall. This change in the insurance premium is attributable to the moral hazard problem.

This result again shows that without the possibility of borrowing and lending, market insurance and self-protection are substitutes in presence of moral hazard. When observation of care is not possible for insurer, market insurance discourages individuals to spend on self-protection because of moral hazard problem but the optimal insurance policy offers positive coverage i.e. moral hazard can't eliminate the possibility of market insurance.

Model with lifetime endowment.

An alternative model that mimics perfect capital market (agents can trade their own consumption between periods) where we assume that agents are endowed with the state contingent commodity C, consumption between two periods, and there are two states of nature in the second period. Thus agent maximizes expected lifetime utility as:

$$U[C_1] + \beta[p(h)U(C_2) + (1 - p(h))\{(1 - v_1)U(C_2 - v_2)\}] \quad (9)$$

subject to the constraint $C_1+C_2+h=\theta$; where θ is the total endowment, h is the direct amount spent on health and $h<\theta$, C_1 and C_2 are consumptions in two periods where the transfer between two periods consumption is possible (which means self-insurance can be an option) , v_1 is the diminished capacity of consumption and v_2 is the income loss and finally β is the discount factor. The individual chooses C_1, C_2 and h to maximize U. Utility depends on how C_1 and C_2 are spent.

The model has changed from the endowment specific model (previous model) in the sense that now individuals can transfer the consumption between periods, so the possibility of self-insurance exists in this model. There are essentially two ways to transfer consumption from the first period to (expected) consumption in the second period. The individual can transfer by spending on health development, h and alternatively by shifting the consumption between C_1 and C_2 directly. In other words, in this model individuals establish reserves for possible future losses instead of purchasing market insurance.

The individual optimum is found when the expected marginal utility per dollar is the same across states. The representative agent maximizes expected utility (equation 6) to the choices of C_1, C_2, h subject to the total endowment constraint.

First order necessary conditions with respect to C_1 is

$$U'[C_1]+\lambda=0 \qquad (10)$$

with respect to C_2 is

$$\beta[p(h)U'(C_2)+(1-p(h))\{(1-v_1)U'(C_2-v_2)\}]+\lambda=0 \qquad (11)$$

with respect to h is

$$\beta p'(h)[U(C_2)-\{(1-v_1)U(C_2-v_2)\}]+\lambda=0 \qquad (12)$$

with respect to λ is

$$C_1+C_2+h-\theta=0 \qquad (13)$$

Combining equation (10) and (11) we have

$$U'(C_1)=\beta[p(h)U'(C_2)-(1-p(h))\{(1-v_1)U'(C_2-v_2)\}] \qquad (14)$$

Equation (14) tells us that the marginal utility in the first period is equal to the expected marginal utility in second period.

Again equating (10) and (12) we get

$$U'[C_1]= \beta p'(h)[U(C_2)-\{(1-v_1)U(C_2-v_2)\}] \qquad (15)$$

Equation (15) implies marginal utility from consumption of C_1 in first period is equal to the expected marginal benefit from spending on h. Using equations 10 and 11 we have $U'[C_1] =\beta[p(h)U'(C_2)+(1-p(h))\{(1-v_1)U'(C_2-v_2)\}]$ So, MU_{C1} is equal to MU_{C2}.

Therefore, marginal utilities are the same across states.

ion for individual optimum.

Possibility of Market Insurance.

If we allow market insurance in this model, it can be shown that agents will have no incentive to purchase the market insurance because of opportunity of self-insurance (i.e. by transferring income from period one to period two). Agents pay *I* as insurance premium in the first period to get benefit of B in the second.

The expected utility is

$U[C_1]+\beta[p(h)U(C_2)+(1-p(h))\{(1-v_1)U(C_2-v_2+B)\}]$ and agents will maximize expected utility subject to the constraints:

1.$C_1+C_2+h+I=\theta$

2. $I=(1-p(h))B$.

Here *I* is the direct amount spent on insurance in the first period and restriction on *I* is $I<\theta$ and since no more than the total of θ can be allocated to h or *I* we need the additional constraint that $h+I<\theta$. Individuals pay *I* for insurance to get B as expected payoffs in the second period if get sick, and it depends on insurance premium (*I*) and spending on lifestyle behavior. Under fair market these two pay-offs are equal.

Substituting B from the second constraint to the expected utility function we get

$$U[C_1]+\beta[p(h)U(C_2)+(1-p(h))\{(1-v_1)U(C_2-v_2+\frac{I}{(1-p(h))})\}] \qquad (16)$$

The first order optimality conditions with respect to C_1, C_2, h, *I* and λ are as follows.

FOC with respect to C_1

$$U'[C_1]+\lambda=0 \qquad (17)$$

with respect to C_2

$$\beta[p(h)U'(C_2)+(1-p(h))\{(1-v_1)U'(C_2-v_2+\frac{I}{(1-p(h))})\}]+\lambda=0 \qquad (18)$$

with respect to h

$$\beta p'(h)[U(C_2)-(1-v_1)\{U(C_2-v_2+\frac{I}{(1-p(h))})\}-(1-v_1)$$
$$\{U'(C_2-v_2+\frac{I}{(1-p(h))}\}(\frac{I}{(1-p(h))})]+\lambda=0 \qquad (19)$$

with respect to *I*

$$\beta[(1-p(h))\{(1-v_1)U'(C_2-v_2+\frac{I}{(1-p(h))})\}\frac{1}{(1-p(h))}]+\lambda=0 \qquad \textbf{(20)}$$

with respect to λ

$C_1 + C_2 + h + I - \theta = 0$

Combing equation (18) and (19) we have

$$\beta[p(h)U'(C_2)+(1-p(h))\{(1-v_1)U'(C_2-v_2+\frac{I}{(1-p(h))})\}]=$$

$$\beta p'(h)[U(C_2)-(1-v_1)\{U(C_2-v_2+\frac{I}{(1-p(h))})\}-(1-v_1)\{U'(C_2-v_2+\frac{I}{(1-p(h))}\}(\frac{I}{(1-p(h))})]$$

Rearranging and substituting terms we have

$$\beta\ p(h)U'(C_2)+(1-p(h))mu_I = mu_h \qquad (21)$$

where,

$$\beta p'(h)[U(C_2)-(1-v_1)\{U(C_2-v_2+\frac{I}{(1-p(h))})\}-(1-v_1)\{U'(C_2-v_2+\frac{I}{(1-p(h))}\}(\frac{I}{(1-p(h))})]$$

$= mu_h$, and

$$\beta(1-v_1)U'(C_2-v_2+\frac{I}{(1-p(h))})] = mu_I$$

Equation (21) implies that marginal utility of spending on h is always greater than marginal utility of buying market insurance. That means given a choice between spending another unit of consumption on insurance or healthy lifestyle choices, it is always beneficial for agents to spend on healthy lifestyle. Thus there is no room for market insurance in this model.

Therefore, there is no need for an insurance market because agents can transfer income (in expected value sense) from period 1 to period 2. Spending on market insurance to mitigate the future burden of the disease is redundant. When the substitution between C_1 and h is not proportional (assuming non-linear p(h) function) transfer between C_1 and C_2 will depend on the elasticity of substitution. Because of perfect capital market individuals can self –insure to reduce the severity of any loss should it occur due to disease onset in future.

In this model we also think that a government program that taxed healthy people in the second period and distribute benefits to the sick people will produce the same results as in the period specific model.

<u>Conclusion and Future research</u>

Using a simple two period model under the state-preference approach this paper finds the optimal level of spending on health promotion to mitigate the probability of illness in the future. This means that investment in health is not only increase individual productivity but it also lowers the likelihood of illness in future. This findings shows that diseases with increasing prevalence rate and exorbitant high patient care costs or long term care costs policy makers should encourage self protecting preventive activities because prevention can reduce the likelihood of disease incidence and avoid the costly consequences of this disease. This simple and transparent model shows that the lifetime decision in health investment and market insurance play very important role in mitigating the risk of the disease onset and future financial burden of the disease when no transfer in income between the periods. The comparative static results also show that with the anticipation of high utility loss and financial loss of disease, individuals respond to spend more on preventive measures and individuals with higher time preference will tend to spend less on preventive health measures. On the other hand individuals can *selfinsure* themselves, instead of buying the market insurance to mitigate the future financial burden of the disease when the transfer of income between periods is possible. One can extend this model considering infinite time periods with non-constant discounting rate, for example, hyperbolic discounting function or with multiple health status instead of just healthy and sick in future periods.

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