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The Public Finance of Healthy Behavior

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Abstract

Lifestyle can often affect the likelihood an individual will have a future illness. Subsidies often mitigate the consequences of poor lifestyle choices. In this paper we explore tax-subsidy policies that lower the consequences of incurring a non-infectious disease. We find that a funding mechanism consistent with current US policy lowers the investment in healthy lifestyles by both the wealthy, who pay taxes, and the poor, who receive subsidies. We also explore alternative policy interventions such as investing in research to lessen the impact or probability of the disease if an individual gets sick.

Key words: lifestyle, health, policy, non-infectious diseases

JEL classification codes: I1, H2, H4

The Public Finance of Unhealthy Behavior

Introduction

Lifestyle can often affect the likelihood an individual will have a future illness.[1] But public policies often mitigate the consequences of poor lifestyle choices on health outcomes by offering public subsidies for care if ill. Similarly, market mechanisms like insurance can spread the personal risk of not taking care of oneself, inducing moral hazard. In this paper we explore the implications of public policies for healthy behavior that would lower the probability of incurring a non-infectious disease. Besides looking at the effects of different tax structures to finance the public subsidies for the poor, we also explore alternative interventions such as investing in research to lessen the impact or probability of the disease if an individual gets sick.

The problem is linked to public welfare issues by two salient facts: most tax incidence falls on wealthier individuals and most government subsidies for health insurance benefit the non-wealthy. Formal health insurance programs for the poor such as Medicaid generally benefit lower income people[2]. Government subsidies for health insurance go far beyond the

[1] Obesity, for example, has been linked to certain types of cancers and is considered a primary cause of cardiovascular disease (Must, et. al., 1999), diabetes, and even Alzheimer 's disease (Pope et al. 2003). Nevertheless, two out of three US adults are overweight or obese (Manson and Bassuk, 2003 and CDC).

[2] The largest federal health insurance program, Medicare, provides the majority of its benefits irrespective of income and is funded by a broadly based payroll tax. Because both high and low income individuals support it, Medicare may be viewed as primarily a transfer from the healthy to the sick (albeit across generations) and not a transfer from the healthy wealthy to the sick

formal programs. Private health insurance costs are deductible to employers and the self-employed, and healthcare costs are deductible as well, with even first dollar costs avoiding taxes if paid through medical savings accounts or flexible spending accounts. Thus the subsidy side of impacts a large portion of the population.

The government revenue side of this equation is, however, much concentrated. IRS data (Internal Revenue Service, 2009) shows that in 2007 people with incomes above $200,000 paid almost 53% of all federal income taxes, and when added to those with incomes above $100,000 the wealthiest taxpayers (less than 12% of the population) contributed almost 74% of all income taxes[3].

We address this structure by considering two types of people – wealthy people who contribute to the public subsidies but are not necessarily eligible for them and another group, the non-wealthy called, for convenience, poor people who do not contribute to the public subsidies but whom collect them if ill. In such a society with two income groups, high and low, where ill individuals from the low income group enjoy publicly funded healthcare if sick and the funding comes from the healthy higher income individuals, the model predicts that both high and low income individuals invest less in self-protection (healthy lifestyle) than is socially

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poor, which is what this paper analyzes. Also see the section entitled "A Digression Back to High Income People" for more on this broader interpretation of the health insurance subsidy.

[3] Recent public policy proposals by the Obama administration would increase the transfers from higher income groups to subsidize the health insurance of the non-wealthy. Among the policies proposed are a tax on employer provided health insurance and a income tax surcharge on the highest income groups. The latter policy, especially, increases the subsidy from the wealthy to the poor.

optimal, the poor because becoming ill has less of an impact on them, and the rich because staying healthy has less incremental value when compared to getting sick.

We use a two-period version of a state-preference model where individuals decide in the first period of life is how much of their income to devote to self-protection which lowers the probability of becoming ill in the second period of life. In the second period of life a person finds himself or herself either healthy or sick, the probability of each outcome depending on how much self-protection was taken in the first period. In a society with two income groups, high and low, where ill individuals from the low income group enjoy publicly funded healthcare if sick and the funding comes from the healthy higher income individuals, essentially mimicking the Medicaid and other public finance systems for subsidized health care as it currently exists, the model predicts that both high and low income individuals invest less in self-protection (healthy lifestyle) than is socially optimal. Within this context we then explore alternative tax structures to finance the subsidies, and also explore an alternative public policy, investing in research to lessen the impact or probability of the disease as opposed to subsidizing those who become ill.

The remainder of this paper is organized as follows. In the next section we provide a brief review of the relevant literature. Next we develop a model in which healthy wealthy individuals subsidize poor sick individuals. After using that model to explore behavior with respect to a healthy lifestyle and social optimum, three additional policies are analyzed; one is an alternative tax scheme, the other two look at alternative policies which would either lower the probability of illness or lessen the utility loss of being ill. The last section of the paper

offers some conclusions and implication.

Literature Review

The early literature on individual health investment did not necessarily link lifestyle and health investment to preventive behavior. Grossman's seminal 1972 paper treated health investment as human capital, improving future productivity and hence increasing future consumption. Chang (1996), Lijas (1998) and Picone, et. al. (1998) all add uncertainty to the Grossman model to show how individuals use health investment to hedge against potential future income loss. Cropper (1977) added direct utility loss for illness to the Grossman model, but because the utility loss was transitory, it had no long-term effect on health investment.

An additional literature developed trying to explain unhealthy behavior. Smith and Tasnadi (2007), among others, offers a biological basis for unhealthy behavior, including smoking, obesity, and other activities that contribute to ill health. A series of papers (Levy, 2002; Komlos, Smith and Bogin, 2004; Becker and Murphy, 1988; and Bednarek, Jeitschlo and Pecchinino, 2006) offer such varied explanations for unhealthy behavior as high rates of time preference, time inconsistent preferences, rational addiction, and adjustment costs.

At the same time Grossman introduced health as human capital Ehrlich and Becker (1972) analyzed the interaction between the market insurance and prevention activities, finding that market insurance and self-protection can be complements depending on the level of probability of loss. Courbage and Coulan (2004) also find a complementary relationship between market insurance and self-protection in full information, but that when there is

asymmetric information self-protection and market insurance are substitutes.

Meanwhile, little attention was paid to the public finance aspects of healthy behavior until the 1990s. A large number of papers explored the social welfare consequences of different programs like Medicare (Feldstein, 1999; McClellan and Skinner, 1997; and Lee, McClellan and Skinner, 1999) and Medicaid (Hubbard, Skinner and Zeldes, 1995; Dubay and Kenney, 1997). Bednarek and Pecchenino (2002) discuss the well-being of different socioeconomic and age groups from the tax-benefit structure that underlies the US health care system. They find the optimal structure of the benefits of a publicly funded system is sensitive to the social welfare function.

In the spirit of Bednarek and Pecchenino, one aspect of our analysis is on the social welfare consequences of the financing system, although the emphasis in this paper is on preventive behavior rather than general equilibrium. And although both models use probabilistic models of disease in the second period of life, Bednarek and Pecchenino treat the probability of illness as exogenous while the point of the analysis here is how that probability responds to the financing system, revealing moral hazard on the part of all participants in the economy. In this respect the present paper is more in the spirit of Bednarek, Pecchenino and Stearns (2008) which looks how individuals respond to social norms when making health investments (in terms of healthy activities and medical care) in early periods of life to achieve a desired health level later in life; an idea similar to the original Grossman model. They use this model to understand how health investment responds to social norms. We use our model to understand how private health investment responds to public financing.

A Model of Taxes, Subsidies and Health Investment

Consider a society consisting of two groups, those with high incomes (subscript w) and those with low income (subscript p). There are n_w wealthy people and n_p low income people. High income people receive an endowment in each period of C_{wi} and low income people receive an endowment each period of C_{pi} for i=1,2 with $C_{wi} \geq C_{pi}$. Individuals, whether wealthy or poor, spend their endowment on two things, goods consumption and health investment. Utility is derived from goods consumption only[4].

All individuals live two periods. All are healthy in the first period, but face a probability of sickness in period 2. For individual i the probability of being healthy in period 2 is $\rho(h_i)$ where h_i is the amount of period 1 (endowed) income devoted to building health, and $0 \leq \rho(h_i) \leq 1$ for i=w,p and $\rho'(h_i)>0$ and $\rho''(h_i)<0$. Thus, by investing in health the individual can lower her probability of illness in period 2.

[4] Often investing in one's health costs less than not doing so. Eating less takes less income than eating more; bicycling for transportation costs less than using a car. In the context of this model, however, that would make investing in health a free good as they would have to give up no other consumption to do so, and we would expect people to invest in their health until the marginal utility was zero. Moreover, the high-incidence of behaviorally related health problems such as obesity indicates that this is not the case; that in fact, improving ones health in some way lowers ones utility. The characterization of the utility arguments used here captures this idea. We implicitly assume there is no "fast lane" effect (Phelps, 2003, p. 106) of higher income on health, that is, those with greater incomes do not necessarily consume a less healthy lifestyle. At the same time, the "health spa" effect is possible because of the greater ability to invest in a healthier lifestyle that the greater income affords the individual.

If a person is sick in period 2 utility is decreased by two parts – an income decrement to pay for care, denoted s, and an enjoyment decrement, denoted *v*.[5] The government offers a subsidy of B to low income people if they are sick in the second period to help pay for the cost of care. The government collects a tax on wealthy people who are healthy in the second period[6] of t_2 to pay for this subsidy. The program is intended to be self-sustaining so in expectations there is a constraint that:

$$t_2\rho(h_w)n_w = B(1-\rho(h_p))n_p \quad (1)$$

Utility each period is U(·) with U′>0 and U″<0. Expected utility for a high income person is

$$U(C_{1w} - h_w) + \beta\rho(h_w)U(C_{2w} - t_2) + \beta(1-\rho(h_w))U(C_{2w} - s - v) \quad (2)$$

Expected utility for a low income person is

$$U(C_{1p} - h_p) + \beta\rho(h_p)U(C_{2p}) + \beta(1-\rho(h_p))U(C_{2p} - s - v + B) \quad (3)$$

where β is the rate of time preference. High income people maximize (2) with respect to h_w and low income people maximize (3) with respect to h_p.

[5] An alternative specification is to make u a scaling variable on utility rather than a decrement. Doing so does not change the primary conclusions.

[6] In a subsequent model instead of t_2 we explore a tax, t_1, on all wealthy in the first period, to pay for B.

First order necessary conditions

HIGH INCOME PEOPLE

The first-order necessary conditions for high income people choosing h_w is

$$-U'(C_{1w}-h_w)+\beta\rho'(h_w)[U(C_{2w}-t_2)-U(C_{2w}-s-v)]=0 \qquad \text{thus}$$

$$U'(C_{1w}-h_w)=\beta\rho'(h_w)[U(C_{2w}-t_2)-U(C_{2w}-s-v)] \qquad (4)$$

Equation (4) indicates that the individual spends on h_w so that the marginal cost, in terms of lost utility in the first period, equals the expected marginal benefit, in terms of the expected value of not getting sick, in period 2. Graphically we can find the solution for h_w as shown in figure 1. From this graph we see that increasing t_2 shifts the downward sloping curve down, thus lowering the optimal h_w. Similarly, a stronger rate of time preference, indicated by a smaller β, will also lower optimal h_w. Larger values for s and v shift the downward sloping curve up, increasing optimal h_w. One question is why the higher taxes lower the self-protection investment among high-income people. Looking at the right-hand-side of (4) we see that the expected marginal benefit of not getting sick goes down. Quite simply, higher taxes (if healthy in their second period of life) makes being healthy less valuable, hence individuals invest less in preventive care. This conclusion is not solely an income effect from paying higher taxes. There is also a substitution effect. Since the expected marginal value of staying healthy falls, wealthy people substitute away from it in their first period consumption.

LOW INCOME PEOPLE

The first-order necessary conditions for low income people choosing h_p is

$$-U'(C_{1p} - h_p) + \beta\rho'(h_p)[U(C_{2p}) - U(C_{2p} - s - v + B)] = 0 \qquad \text{thus}$$

$$U'(C_{1p} - h_p) = \beta\rho'(h_p)[U(C_{2p}) - U(C_{2p} - s - v + B)] = 0 \qquad (5)$$

Once again this indicates that the individual spends on h_p so that the marginal cost, in terms of lost utility in the first period, equals the expected marginal benefit, in terms of the expected value of not getting sick, in period 2. Graphically we can find the solution for h_p as shown in figure 2. From this graph we see that increasing *B* shifts the downward sloping curve down, thus lowering optimal h_p. Similarly, a stronger rate of time preference, indicated by a smaller β, will also lower optimal h_p. Larger values for s and v shift the downward sloping curve up, increasing optimal h_p.

A Digression Back To High Income People

In the United States most high income people have health insurance either through employment or purchase, and for the insurance provided through employment is not taxed. Thus, one should ask why the same government subsidized insurance problems do not apply to the wealthy. Primarily, it is because tax collections are so skewed – recall that almost three-fourths of all taxes are paid by those with incomes above $100,000. Hence, this argument simply changes what we mean by wealthy and poor. At first look, we might think the poor are those on programs like Medicaid and the wealthy are all others. However, when we look at the tax data, a more realistic interpretation might be that the wealthy are those with incomes

above $100,000 (again, less than 12% of the population), and the "poor" are all others who receive subsidized health insurance, through low income programs or tax-deductible employer sponsorship. With private non-subsidized health insurance so expensive, this latter interpretation actually may be more appropriate than the narrower focusing on what the government currently calls the poor.

But even under a more restrictive definition the wealthy have (as noted, subsidized) health insurance and thus are subject to the same moral hazard problem of not investing in a healthy lifestyle because insurance will pay for any adverse consequences. However, privately provided health insurance is designed, except for load factors, to be actuarially fair. Hence, even after subsidy any premium paying individual should expect, on average, to pay the expected value of his or her own health care costs. While there is still the moral hazard problem that arises from sharing risk, it is not pertinent to the problem being addressed here. Moreover the general insurance-induced moral hazard problem is well documented in the literature (as far back as Pauly, 1968). In the end, *someone* must be paying the health care bills, and since so much insurance is directly or indirectly subsidized by the government, it must be those paying the majority of the taxes. On average they must lose from the moral hazard created, not gain from it.

EQUILIBRIUM

The program budget constraint $t_2\rho(h_w)n_w = B(1-\rho(h_p))n_p$ helps determine the equilibrium values. If $t_2\rho(h_w)n_w > B(1-\rho(h_p))n_p$ then too much tax is collected, and policy

makers can decrease t_2 (which will increase h_w) or increase B (which will decrease h_p). If tax collections are insufficient to support the subsidy for ill poor people the movements would be in opposite directions. Suppose $t_2\rho(h_w)n_w > B(1-\rho(h_p))n_p$. If the government chooses to decrease t_2 then high income people have less disincentive to invest in a healthy lifestyle. This means both h_w and $\rho(h_w)$ will increase so the net change in program revenue (the left-hand side of the constraint) is uncertain. However, if the government increases B then program spending (the right-hand side of the constraint) unambiguously increases because h_p, and hence $\rho(h_p)$ decrease with B. If the inequality is in the other direction then lowering B unambiguously lowers program costs so the government can always find a (t_2, B) so that equilibrium is achieved.

It is interesting to know under what conditions t_2 can be lowered to achieve equilibrium. Assume again that revenue collections exceed the subsidy payments. The derivative of $t_2\rho(h_w)n_w$ with respect to t_2 (suppressing n_w) is simply $\rho(h_w)+t_2 d\rho(h_w)/dt_2$. From figure 1 it is obvious that $d\rho(h_w)/dt_2 < 0$ hence the derivative of $t_2\rho(h_w)n_w$ is positive only if $\rho(h_w)/t_2 > -d\rho(h_w)/dt_2$ which means the average probability of good health per unit of tax exceeds (the absolute value of) the marginal probability of good health per unit of tax. This is the condition needed for cutting t_t to move the policy towards equilibrium. Otherwise, increasing the tax will move the policy towards equilibrium. We find an interesting example of a quasi-Laffer effect.

SOCIAL UTILITY

Social utility is defined here as the weighted sum of individual expected utility. If the weights are equal for all individuals then this optimum is Pareto Optimal. Allowing the weights to vary accounts for more or less relative importance of the utility of wealthy or poor people in a social utility function. A social optimum would thus choose h_w, h_p, B and t_2 subject to the constraint that taxes collected must cover the subsidy. The social utility function is

$$\begin{aligned} V_w n_w\{U(C_{1w}-h_w)+\beta\rho(h_w)U(C_{2w}-t_2)+\beta(1-\rho(h_w))U(C_{2w}-s-v)\} \\ +V_p n_p\{U(C_{1p}-h_p)+\beta\rho(h_p)U(C_{2p})+\beta(1-\rho(h_p))U(C_{2p}-s-v+B)\} \end{aligned} \quad (6)$$

where V_w and V_p are the relative weights placed on wealthy and poor utility, respectively. Equation (6) is maximized subject to the constraint

$$t_2\rho(h_w)n_w = B(1-\rho(h_p))n_p$$

which yields the following first order necessary conditions, with respect to h_w, h_p, t_2, B and λ:

$$V_w n_w\{-U'(C_{1w}-h_w)+\beta\rho'(h_w)[U(C_{2w}-t_2)-U(C_{2w}-s-v)]\}+\lambda n_w t_2\rho'(h_w)=0 \quad (6a)$$

$$V_p n_p\{-U'(C_{1p}-h_p)+\beta\rho'(h_p)[U(C_{2p})-U(C_{2p}-s-v+B)]\}+\lambda n_p B\rho'(h_p)=0 \quad (6b)$$

$$V_w n_w\{-\beta\rho(h_w)[U'(C_{2w}-t_2)\}+\lambda n_w\rho(h_w)=0 \quad (6c)$$

$$V_p n_p\{\beta[1-\rho(h_p)][U'(C_{2p}-s-v+B)]\}-\lambda n_p[1-\rho(h_p)]=0 \quad (6d)$$

$$t_2\rho(h_w)n_w - B(1-\rho(h_p))n_p = 0 \quad (6e)$$

From equations (6c) and (6d)

$$V_w[U'(C_{2w}-t_2)=\lambda=V_p[U'(C_{2p}-s-v+B)] \quad (6f)$$

indicating that t_2 and B should be chosen such that the weighted marginal utility of the wealthy after paying the tax (the cost of the tax) equals the weighted marginal utility of the poor from the subsidy (the benefit of the tax).

From (6a) we find that

$$U'(C_{1w} - h_w) = \beta\rho'(h_w)[U(C_{2w} - t_2) - U(C_{2w} - s - v)] + \frac{\lambda t_2 \rho'(h_w)}{V_w} \quad (6h)$$

λ is the (socially weighted) marginal utility of consumption, which should be positive. Thus the second term on the right hand side is positive. And so the marginal utility of healthy wealthy in the first period is larger in the social optimum than with free choice (see equation 4). This means C_{1w}-h_w must be smaller in the social optimum, so the socially optimum h_w exceeds h_w* from figure 1.

Similarly, from (6b) we find that

$$U'(C_{1p} - h_p) = \beta\rho'(h_p)[U(C_{2p}) - U(C_{2p} - s - v + B)] + \frac{\lambda B \rho'(h_p)}{V_p} \quad (6i)$$

Again the second term on the right hand side is positive, so we find that the socially optimum h_p exceeds h_p* also.

From (6h) and (6i) we can find that

$$\frac{V_w\{U'(C_{1w} - h_w) - \beta\rho'(h_w)[U(C_{2w} - t_2) - U(C_{2w} - s - v)]\}}{V_p\{U'(C_{1p} - h_p) - \beta\rho'(h_p)[U(C_{2p}) - U(C_{2p} - s - v + B)]\}} = \frac{t_2\rho'(h_w)}{B\rho'(h_p)} \quad (7)$$

Interpreting (7) is somewhat difficult. We know if individuals are left to choose their own levels of h_w and h_p then, from (4) and (5) both the numerator and denominator of the left-hand-side would be zero. But we also know from (6g) and (6f) this is not the case in the social optimum, and in fact the left hand side numerator and denominator of (7) measure the social gain (and individual burden) from increasing investment in healthy lifestyle. The ratio of this burden on

the healthy wealthy and the ill poor should reflect the tax or benefit weighted impact on the marginal change in the probability of illness the second period.

Since h_w and h_p are "controllable" by choosing t_2 and B hence we can write

$$h_w = g(t_2) \qquad and \qquad h_p = f(B)\,.$$

Substitute these into (6) and state social utility as

$$\begin{aligned} V_w n_w \{U(C_{1w} - g(t_2)) + \beta\rho(g(t_2))U(C_{2w} - t_2) + \beta(1-\rho(g(t_2)))U(C_{2w} - s - v)\} \\ + V_p n_p \{U(C_{1p} - f(B)) + \beta\rho(f(B))U(C_{2p}) + \beta(1-\rho(f(B)))U(C_{2p} - s - v + B)\} \end{aligned} \tag{8}$$

and maximize with respect to only t_2 and B. This social utility function would be maximized subject to the tax-subsidy constraint

$$t_2\rho(g(t_2))n_w = B[1-\rho(f(B))]n_p$$

to find exact values for t_2 and B.

Taxing all the Wealthy Young

The previous model taxed only the healthy wealthy on social mores of not taxing the poor or the sick. An alternative tax structure could be to impose the tax on all wealthy individuals in the first period. In this model the wealthy optimization problem becomes

$$U(C_{1w} - h_w - t_1) + \beta\rho(h_w)U(C_{2w}) + \beta(1-\rho(h_w))U(C_{2w} - s - v) \tag{9}$$

and the first-order condition is

$$-U'(C_{1w} - h_w - t_1) + \beta\rho'(h_w)[U(C_{2w}) - U(C_{2w} - s - v)] = 0 \qquad \text{thus}$$

$$U'(C_{1w} - h_w - t_1) = \beta\rho'(h_w)[U(C_{2w}) - U(C_{2w} - s - v)] \tag{10}$$

Figure 3 shows the optimization condition graphically. We see as with the period 2 tax only on the healthy wealthy, wealthy individuals will invest less in protective lifestyle activities than in the absence of the tax. However, the cause of the decrease in the investment wealthy people

make in their own future health is different. Recall if the tax is imposed when the wealthy are old the *marginal value* of being a healthy rather than ill older person goes down for the wealthy. In this case, the decrease in protection investment comes because the marginal utility of consumption while young increases. As with taxes on the older healthy wealthy, there is again an income and substitution effect. With lower after tax income the younger wealthy have higher marginal utility. This is the "price" (in terms of opportunity cost) of spending on a healthy lifestyle. Since the price has gone up, the younger wealthy buy less of it.

At issue is how the decreased investment compares between the two taxes. With the first period tax wealthy individuals have more to lose if they get sick, providing more of an incentive to invest in a healthy lifestyle when young. This is offset, however, by lower after tax endowment to allocate between consumption and healthy living. Comparing the right hand side of (10) to the right hand side of (4) we see that for any given level of h_w and t_2>0 $\beta\rho'(h_w)[U(C_{2w})-U(C_{2w}-s-v)] > \beta\rho'(h_w)[U(C_{2w}-t_2)-U(C_{2w}-s-v)]$. On the other hand the left hand side of (10) is also larger than the left hand side of (4), again for any given level of h_w and t_1 >0 by diminishing marginal utility. Thus both the marginal cost (in terms of lost first period utility) and the marginal benefit (in terms of avoiding a higher loss if sick) of investing in healthy lifestyle increases by this tax scheme, and the net effect on how much the wealthy invest in health is uncertain. Which is larger depends on the relative slopes of the two curves. The government budget constraint is now

$$t_1 n_w = B(1-\rho(h_p))n_p \qquad (11)$$

and we void the ambiguity that came with taxing in the second period; increasing the tax rate will always increase tax collections and decrease investment in a healthy lifestyle.

Subsidizing Healthy Lifestyles of the Poor[7]

Much publicly funded insurance programs for the poor have a distinct focus on children.[8] In addition, they increase the access of the poor to preventive healthcare such as inoculations and, perhaps more important, early intervention and treatment for diseases such as diabetes, heart disease, obesity and cancer that can lower illness and related costs later on. In the context of the analysis in this paper we add a government provided grant of healthy lifestyle, $\overline{h}_p$, for the poor. Thus, equation (3) now becomes

$$U(C_{1p} - h_p) + \beta\rho(h_p + \overline{h}_p)U(C_{2p}) + \beta(1 - \rho(h_p + \overline{h}_p))U(C_{2p} - s - v + B) \quad (12)$$

There is no change in the utility function of the wealthy.

With this addition the first-order condition for the poor becomes

$$U'(C_{1p} - h_p) = \beta\rho'(h_p + \overline{h}_p)[U(C_{2p}) - U(C_{2p} - s - v + B)] = 0 \; . \quad (13)$$

For any given h_p we know that $\rho'(h_p + \overline{h}_p) < \rho'(h_p)$ which has the effect of shifting the downward sloping curve in figure 2 downward even more from the no government subsidy

[7] Thanks to an anonymous referee who pointed out the preventive aspect of publicly subsidized insurance.

[8] The Children's Health Insurance Program (CHIP) works along with Medicaid to provide health insurance for low income children. The states have different eligibility rules, but in most states, uninsured children 18 years old and younger whose families earn up to $34,100 a year (for a family of four) are eligible for subsidized coverage and healthcare, including preventive care

benchmark of $B = 0$ and in fact for any given level of B ,"granting" some healthy lifestyle to the young poor (for example, by providing preventive care and early illness intervention) decreases own investment in healthy lifestyle by the poor. However, because $\rho''(h_i)$<0, U'>0 and U"<0 the offset is less than complete, and the total investment in healthy lifestyle by the poor is higher.

For any given level of taxes, if part of the government spending is towards lifestyle enhancements for the poor, B must go down. Keeping taxes on the wealthy young, the government budget constraint becomes

$$t_1 n_w = B(1-\rho(h_p))n_p + \bar{h}_p n_p \qquad (14)$$

so any spending on $\bar{h}_p$ comes at the expense of B if the poor pay this burden, or increased tax burden on the wealthy. If the latter is chosen, of course, the wealthy invest even less in their own healthy lifestyle by the analysis above and there is increased gain for the poor. However, putting the burden on the poor, so policy is to use some tax money for preventive care rather than curative or palliative care (i.e., akin to current Medicaid and CHIP programs) offers an intriguing policy perspective. Higher $\bar{h}_p$, as we have seen, lowers h_p. Lower B raises h_p. If overall the impact is that h_p is smaller, marginal utility in the first period is larger, so first-period utility is also larger. And the marginal expected utility (as opposed to the expected marginal utility) must be smaller as well to keep (13) in equality. Since marginal expected utility has gone down, expected utility must have gone up. The overall implication is that, for any given government spending and taxes on the wealthy, programs that include preventive healthcare,

like Medicaid and other current programs do, benefit the poor more than programs that include only palliative and curative healthcare.

Improving the Odds

An alternative policy is to invest tax revenues in research to improve the odds that a healthy lifestyle avoids illness later in life. For this policy we retain the tax imposed on all young wealthy individuals. Thus for the wealthy the problem is to maximize

$$U(C_{1w} - h_w - t_1) + \beta\delta(h_w)U(C_{2w}) + \beta(1-\delta(h_w))U(C_{2w} - s - v) \quad (15)$$

where $\delta(h_w) > \rho(h_w)$ for all h_w and the government has used the tax revenue collected in period 1 to improve the payoff of a healthy lifestyle. This policy, of course, affects the poor as well, giving them the objective function

$$U(C_{1p} - h_p) + \beta\delta(h_p)U(C_{2p}) + \beta(1-\delta(h_p))U(C_{2p} - s - v) \quad . \quad (16)$$

The first order conditions are analogous to (10) (for the wealthy) and (5) (for the poor) with $\delta'(h_w)$ replacing $\rho'(h_w)$. Assuming the research is such that healthy lifestyle both improves the probability of avoiding illness in the second period of life and that the fall off in the probability is smaller (i.e., the impact of greater h_i diminishes at a slower rate) we would expect that $\delta(h_w) > \rho(h_w)$ and $\delta'(h_w) < \rho'(h_w)$. Investing in health has a bigger payoff for all, and both the poor and wealthy would invest more, with or without a tax and benefit scheme. In all the graphs, the downward sloping lines shift upward increasing the investment in healthy lifestyle with or without the subsidy of the ill poor in the second period of life.

In some respects this is the more desirable approach as long as the research subsidy is successful in improving the odds that a healthy lifestyle lowers the probability of illness in the future. Most importantly, the benefits accrue to all individuals, not just the poor, although, as before, we assume the wealthy pay for the program. If this program is done in conjunction with a subsidy to the sick poor the government budget constraint is

$$t_1 n_w = B(1-\delta(h_p))n_p + RC \qquad (17)$$

where RC is the research costs and we assume the program successfully changes the probability function to $\delta(h_w)$ from $\rho(h_w)$. For the same tax level t_1 there is a savings of the amount $Bn_p(\delta(h_p)-\rho(h_p))$ in the benefits paid to the poor which can be used to support the research. From the perspective of the wealthy this program is clearly superior *if the tax paid is the same*. Comparing (15) to (2) we see if t_1 is held constant for all h_w , (15) is larger. Thus, since one option for the wealthy individual is to choose the h_w that would be paid under the tax scheme, she is assured of achieving a higher utility under a research program that lowers the probability of getting sick. Depending on the weights used, then, it is possible to develop a program that leaves society better off in terms of overall utility, at least in an expected value sense.

Lessening Disease Impacts

Research can also lessen the impact of being ill rather than lowering the odds of getting ill. For example, we may find better ways to treat diseases. In terms of the model this would be interpreted as lowering both *s* and *v*. Since this lessens the cost of getting sick both wealthy and poor individuals have less incentive to avoid getting sick. For the poor this is equivalent to

increasing B. For the wealthy the marginal impact is in the same spirit of, but not equivalent to, decreasing t_2.

Once again it is reasonable to explore the implications of the policy is the tax paid by the wealthy is the same. Thus, we have

$$t_1 n_w = B(1-\rho(h_p))n_p + RD \qquad (18)$$

where RD is the cost of research and development of ways to lower s and v. In this case, holding t_1 constant, would require lowering B to free up money for RD. Since s and v are lower, poor individuals can be left equally well-off under either program (that is, B is lowered commensurate with the decreases in s and v) while the wealthy are clearly better off, looking at (2) with smaller s and v. Thus, from a societal welfare analysis, this program is also superior to the pure transfer program.

Conclusions and Implications

We have analyzed the results of a model that allows us to explore some implications of the public finance aspects of taxes and subsidies on noninfectious diseases in an economy with two levels of wealth. Two immediate conclusions come out of the analysis. First, any tax-subsidy scheme lowers the investment in healthy living for both wealthy and poor individuals, and the effect on the wealthy is not just because they have less money. There is a substitution effect away from self-protective activities that compounds the income effect. Second, programs that work to lower the probability or impact of disease produce a larger social utility (holding the tax paid by the wealthy constant) than pure transfer programs because the benefits of lowering the

probability or impact of disease accrue to all, the wealthy as well as the poor, while pure transfer program benefits accrue only to the poor. The implication, of course, is that a responsible government that wants to alleviate the suffering of poor sick people will subsidize research into lessening the probability and impact of disease as well as supporting transfer programs from the rich to the poor.

This paper focuses on Medicaid-type programs that support healthcare for lower income people with taxes on higher income people, to point out an unintended consequence of the program that has not yet been acknowledged in the literature. The moral hazard that Medicaid-type programs create for its recipients is not surprising; any insurance program suffers from moral hazard. What is novel and the focus of this paper is the unintended consequence that health insurance for the poor has on self-protective behavior of the rich.[9] Another very important finding, however, is that, for any given government spending and taxes on the wealthy, programs that include preventive healthcare, like Medicaid and other current programs do, benefit the poor more than programs that include only palliative and curative healthcare.

The analysis is unfinished. More work is needed on determining the optimal transfer from the wealthy to the poor, and the optimal mix of transfers and research. We have shown that this is, essentially, an empirical question. It requires a greater understanding of utility

[9] It is not the intention of this work to put the responsibility for the growing behavioral health problems in the United States on Medicaid and like programs. With taxpayers subsidizing employer sponsored health insurance, public policy is creating moral hazard all around, including among the rich.

functions and the loss that accompanies illness, social weightings between the rich and the poor, and the payoff that can be expected from research into lowering the probability of disease and the lessening the utility loss from disease. Future research should certainly explore these issues.

At the same time, we have significant data available from past instances on transfer programs (and changes in those programs), and on government investment in research to lessen both the probability and impact of noninfectious diseases. To some extent these data might provide the information needed to analyze and determine the optimal policy the public should take towards the prevention of disease, lessening disease impact for all, and transfers from the healthy wealthy to the least fortunate group in society, the poor sick.

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Figure 1

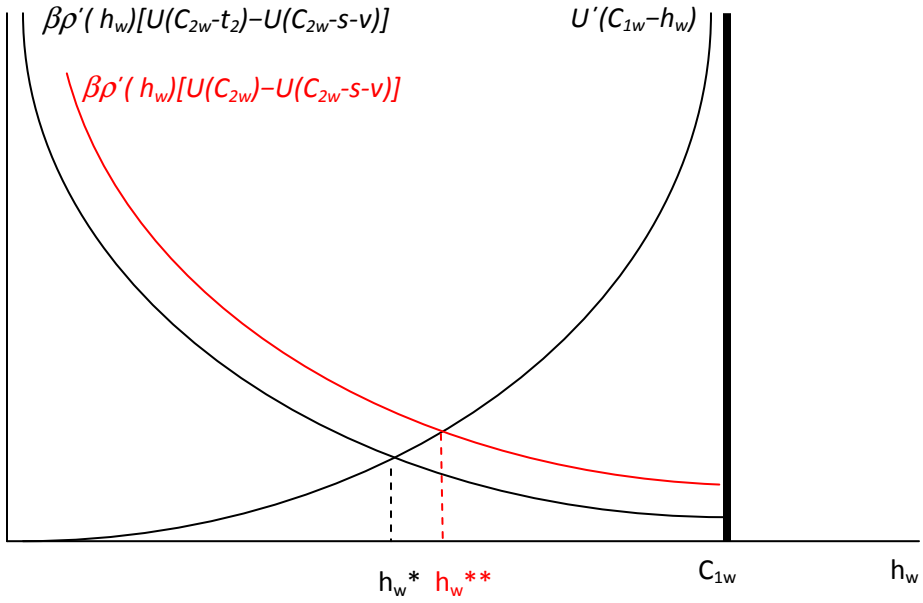

Figure 2

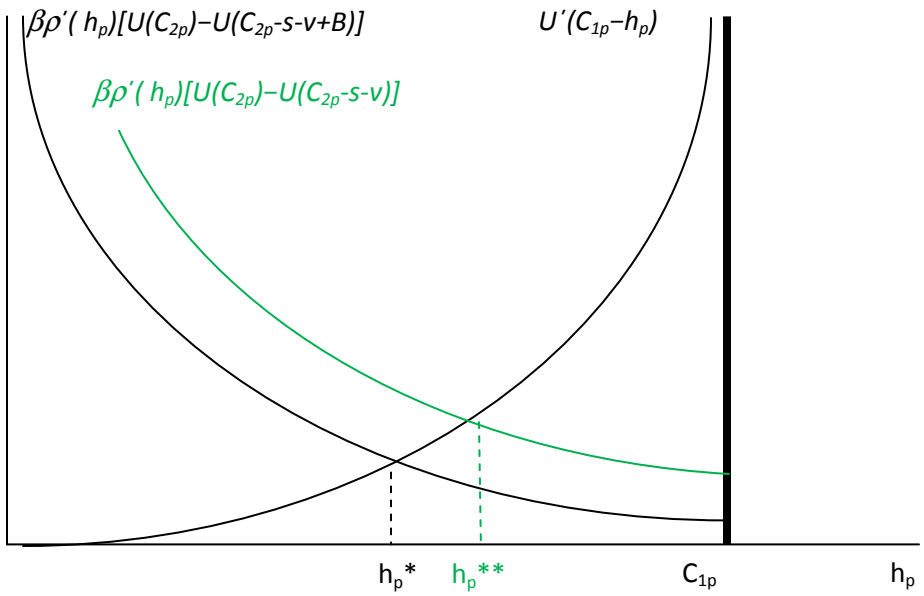

Figure 3