

The market for health insurance with an insurer of last resort

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Abstract

When the government cannot commit to withdraw from providing health care to the sick and uninsured, the market underprovides insurance, a result of what is called the Samaritan's Dilemma. In this paper, we extend the analysis by incorporating a tax structure necessary to finance public expenditures. With proportional taxation, income is redistributed from rich to poor, the users of public health services. Accounting for this income effect, we find that the poor still underinsure, but individuals in the middle of the income distribution may over or underinsure. Moreover, while the rich and the poor consume socially optimal qualities of health care, middle income individuals may demand too much health care quality, if the income effect is strong enough. Our equilibrium analysis then provides qualifications to the two main results in the literature on the Samaritans Dilemma: underinsurance and the first best optimality of in kind transfers.

Keywords: Samaritans Dilemma, Health insurance.

JEL classification codes: H21,I18

1 Introduction

We study the distortions created in the markets for health insurance and health care when individuals have access to a subsidized health care alternative, and these subsidies are financed through proportional taxes. To a different extent, sick people in most countries have access to a health care

option of last resort, usually financed by the government. In the US uninsured people usually have access to a web of public hospitals, not for profit hospitals, and community care centers where services are free or heavily subsidized. By committing to provide a minimum level of health care irrespective of the ability to pay, the government and charities effectively takes on a role of insurer of last resort in the market for health insurance.

Uncompensated care in the US is mostly financed by the government out of general taxes, as described in Hadley and Holahan [2003]. Since the US income tax structure is progressive, the demand for health care and health insurance by poorer individuals -the recipients of uncompensated care- is affected through income effects. As we discuss in this paper, such effects affect the qualitative nature of the demands for health care and health insurance.

As we examine in detail in what follows, the existence of an insurer of last resort creates important distortions in the market for health insurance, which derive from the knowledge by agents that, if uninsured against some event, they can always have recourse to a subsidy to cover their health bill. These distortions are compounded by the redistributive character of the financing of such health care. This question is related to the Samaritan's Dilemma problem, first described in Buchanan [1975], which is known to undermine the optimal provision of social insurance: the government would like to avoid creating distortions by announcing that it will not subsidize health care once the uncertainty regarding future health is resolved, but this announcement would not be credible, as the government will ex-post find in its best interest to subsidize the agents health care bill rather than let him go untreated.

This paper can be seen an equilibrium analysis of the Samaritan's Dilemma applied to social insurance for health shocks, where the financing needs of the government are explicitly considered. In a seminal paper, Buchanan [1975] describes the problem: when an altruist will transfer resources to an individual conditional on being in a bad state, this individual will have reduced incentives to avoid the bad state, or insure against it. Bruce and Waldman [1991] show that in the context of public insurance, the government can overcome its inability to commit and achieve the first best allocation by using transfers in kind, rather than in cash. Coate [1995] provides a similar argument in an environment where the government can commit, but private charity responds to the needs of transfer recipients. In a companion paper, Sepulveda [2006], I study the nature of optimal public health insurance in an environment characterized by the Samaritan's Dilemma and where the government cannot implement redistributive taxation. The contribution of

this paper is to study the equilibrium effects of the lack of commitment when public services are financed through proportional taxation. The empirical importance of the effects of uncompensated care in the US has been studied among others by Herring [2005], who shows that the availability of charity health care in the US reduces the likelihood of obtaining private health insurance coverage, and by Rask and Rask [2000], who show that public programs such as Medicaid have similar effects on families near the poverty line.

We present a static model of health risks where individuals are heterogeneous by wealth (*ex ante*), and by health status (*ex post*). Individuals derive utility from consumption and health. The health status is discrete and comprises, besides good health, two health conditions. There are two qualities of health care treatment available, and individuals choose both a level of insurance and a level of health care quality for each condition. We assume, to simplify the exposition, that the government is unable to commit not to provide a minimum standard of health care, rather than deriving this lack of commitment through altruism as is done in Sepulveda [2006] in a similar framework. We use this model to examine the distortions created by the government's inability to commit in the margins of health care quality utilization and health insurance/consumption, and discuss to what extent proportional taxation can reduce or amplify these distortions. We find that the government's inability to commit results in lower than optimal levels of insurance for individuals at the low end of the wealth distribution, but individuals in the middle of the wealth distribution could be over or underinsured. Health care quality is optimally provided for individuals who are both rich and poor, but those in the middle, may demand too much quality if the income effect created by taxation is strong enough. In this sense, our results qualify the two main results in the literature on the Samaritan's Dilemma: underinsurance and the first best optimality of in kind transfers.

This paper has four sections. In section 2 we present the model, in section 3 we examine the first best allocation, compare it with the equilibrium allocation, and describe the distortions created in the markets for health insurance and health care. The last section concludes.

2 A model of health risks and health insurance

We present a one period model with agents who are heterogeneous in wealth endowments and face a risk to their health. Health shocks affect individual welfare both through a financial loss which reduces consumption, and directly as a utility loss due to poor health. Besides being in good health, agents are faced with two stochastic health states, and must choose at the beginning of the period a level of health insurance for each state. A treatment for health state i is labelled L_i . Each health state may be go untreated, or may be treated using one of two available health care technologies: $L_i \in \{0, High_i, Low_i\}$, differentiated by their cost $C(L_i)$ and the level of utility they bring through better health. In this sense L_i may be thought of as representing the quality of health care. Individual choices therefore have two dimensions: for each stochastic state, agents must decide how much insurance to buy, and what health care technology to use.

This is a model with full information. While informational asymmetries play a central role in the study of the different forms of market incompleteness in health insurance markets, in our problem the distortions are created by the government providing a minimum level of free health care to those who demand it.

Health risks and health care technology. We let s_i denote health state i , with s_1 being good health and $\{s_2, s_3\}$ denoting two illnesses. The probabilities associated to these health states are p_i for $i = 1, 2, 3$. While being in good health is associated with no financial loss, being in poor or catastrophic health implies a financial loss of $C(High_i) = l_i$ if the High technology is used, and $C(Low_i) = \theta l_i$ if the Low technology is used, with $\theta < 1$ and $i = 2, 3$. we assume for simplicity that both illnesses are formally similar, so $l_2 = l_3$ and $p_2 = p_3$. Using two technologies allow us to capture both that health care is a normal good, and that government provided free health care is usually of inferior quality to that obtained through private insurance.

Endowments and timing. Agents are endowed with a wealth level W at the beginning of the period, with wealth following the distribution $G(W)$ with support $[W_0, +\infty) \equiv [\theta(l_2 p_2 + l_3 p_3), +\infty)$. Note that individuals with wealth lower than W_0 would require subsidies in any arrangement if they are to get some treatment. The lower bound W_0 ensures that everyone can afford full insurance with at least *Low* quality health care, and therefore allows for

a clean comparison between the first best allocation, where the government need not provide subsidies, and the equilibrium allocation without commitment.

Two sets of decisions are made. Before the uncertainty is resolved, agents choose simultaneously a level of health insurance h , as well as insurance payments q_2 and q_3 . After the uncertainty is resolved, agents choose a level of consumption c and make health care choices L_i . Individuals can also request government transfers if they become ill and are uninsured. This timing of events is displayed in Figure 1.

Preferences. Agents derive utility from consumption and health, and rank choices according to expected utility

$$U = \sum_{i=1}^3 p_i \{u_1(c_i) + u_2(s_i, L_i)\} \quad (1)$$

That the above function is separable in consumption and health simplifies the analysis and is non essential to the points made by this paper. For u_1 , we choose for simplicity a function that displays constant absolute risk aversion, where r is the risk aversion parameter:

$$u_1(c_i) = -exp(-rc_i). \quad (2)$$

The function u_2 is assumed to be increasing in its second argument, and bounded above by $u_2(s_1)$. This assumption implies that being in good health is preferable to being in bad health even if treated in a very good hospital. We assign a large penalty to the situation where an agent goes without health care treatment if sick. This penalty ensures that no one chooses, absent government insurance, to forgo treatment if ill, and can be heuristically motivated by the individual facing the possibility of death if going without health care treatment. The assumption can be formalized as:

Assumption 1 *Being in states 2 or 3 with $L = 0$ has an infinitely large compensating variation with respect to being in the same state with Low quality health care. For $i \in \{2, 3\}$:*

$$u_1(\lim c \rightarrow +\infty) + u_2(i, 0) < u_1(0) + u_2(i, Low)$$

The budget constraint in health state i for an agent who paid h in health insurance and will receive a payment of q_i in this contingency takes the form

$$c_i = W(1 - \tau) - h - C(L_i) + q_i \quad (3)$$

Where W represents wealth and τ is a tax rate. When healthy, it is understood that $\{L_1, C(L_1)\} = \{0, 0\}$, which implies $q_1 = 0$, so consumption is just $c_1 = W(1 - \tau) - h$.

The market for insurance. There is free entry in the market for health insurance and therefore firms earn zero profits. Since there are no costs of selling insurance, premia are actuarially fair. This implies

$$h = p_2q_2 + p_3q_3 \quad (4)$$

Note that h will differ across wealth levels. For some levels of h , insurance companies will set q_i low enough so as to induce agents to use the freely provided government health care system in the case of event i . In such cases we take the convention that $q_i = 0$. Insurance companies can observe the wealth of each agent, and will offer policies that depend on the amount of insurance purchased h , and therefore indirectly on wealth.

The household problem with commitment. In the first economy we study, the government can credibly commit *not* to subsidize health care for the uninsured. For an agent in this economy the problem is simply to maximize the utility function in 1 subject to the budget constraint 3 and the no profit condition 4. We call this problem $P1$ ¹

$$\begin{aligned} \max_{c_i, h, q_2, q_3, L_2, L_3} \quad & p_1(u_1(c_1) + u_2(s_1)) + p_2(u_1(c_2) + u_2(s_2, L_2)) \quad (P1) \\ & + p_3(u_1(c_3) + u_2(s_3, L_3)) \\ \text{s.t.} \quad & c_i = W(1 - \tau) - h - C(L_i) + q_i \text{ for } i = 1, 2, 3 \\ & h = p_2q_2 + p_3q_3 \end{aligned}$$

Where τ is a tax rate on wealth. A solution to this problem are policy functions for consumption $c : s \times \mathbb{R}^+ \rightarrow \mathbb{R}^+$; for the level of insurance $h : \mathbb{R}^+ \rightarrow \mathbb{R}^+$; for insurance payments $q : s \times \mathbb{R}^+ \rightarrow \mathbb{R}^+$; and for health care treatment $L : s \times \mathbb{R}^+ \rightarrow \{0, Low, High\}$, all functions of the stochastic health state and wealth.

The household problem without commitment. In the second economy we study, the government lacks a commitment technology. In this economy the agent knows that, after the uncertainty is revealed, she can always have

¹In problem (P1), q_i are seen as decision variables of the agents, as opposed to the insurance companies. This distinction is of course irrelevant in the current model, as competition in the insurance industry implies that any pair $\{q_2, q_3\}$ offered by an insurance company must be the preferred choice by agents, subject to the no profit condition 4.

access for free to the Low health care technology. We take the lack of commitment as a given feature of the equilibrium. In Sepulveda [2006] this lack of commitment arises as a result of altruism towards other's health status. The result of including altruism in our framework as in Sepulveda [2006] is that the optimal policy for the government implies ensuring a minimum level of health care for everyone, the same assumption taken here.

The government provides then a form of public health insurance, comparable to that implicit in the charity type of coverage that uninsured individuals have access to in the US, as well as to the public health insurance plans in a number of developing countries, where public insurance benefits are tied to the use of public hospitals. The important feature of this implicit plan is that individuals cannot purchase extra insurance coverage, as in practice benefits from this plan are tied to the use of lower quality health care. We label this plan Pure Public Insurance (PPI).

The agent's problem in this case involves an extra decision: whether to opt for privately provided or government provided health care. We label this variable, D_i for $i = 2, 3$.

$$\begin{aligned}
& \max_{c,h,q_2,q_3,L_2,L_3,D_2,D_3} && p_1(u_1(c_1) + u_2(s_1)) && (P2) \\
& && + p_2 \max\{u_1(c_2) + u_2(s_2, L_2), u_1(W - h) + u_2(s_2, Low)\} \\
& && + p_3 \max\{u_1(c_3) + u_2(s_3, L_3), u_1(W - h) + u_2(s_3, Low)\} \\
& s.t. && c_i = W(1 - \tau) - h - C(L_i) + q_i \text{ for } i = 1, 2, 3 \\
& && h = p_2q_2 + p_3q_3
\end{aligned}$$

A solution to this problem is a set of policy functions $\{c(W), h(W), q(s, W), L(s, W)\}$ similar to those for problem (P1), as well as a policy function $D : s \times \mathbb{R}^+ \rightarrow \{0, 1\}$, that map a health state and a wealth level to a choice of using privately provided health care (0) or free publicly provided health care (1).

The government. The government taxes all agents at a rate τ and uses the proceeds to subsidize health care for those who require it using the Low health care technology. It runs a balanced budget, which implies

$$\tau \int_0^{+\infty} W dG(W) = \theta l_2 p_2 \int \mathbb{I}_{[D_2=1]} dG + \theta l_3 p_3 \int \mathbb{I}_{[D_3=1]} dG. \quad (5)$$

Where \mathbb{I} is an indicator function that takes the value 1 if $D_i = 1$. Proportional taxation implies a degree of redistribution in the financing of public health care which has a good empirical motivation, van Doorslaer et al. [1999] discuss

equity considerations in the financing of health care across a number of OECD countries

Problems $P1$ and $P2$ will allow us to characterize the distortions created by the role of insurer of last resort taken by the government. We present the equilibrium definition for the economy without commitment, the extension to that for the economy with commitment being mechanical.

Equilibrium in the economy without commitment. An equilibrium for this economy is a set of insurance and health care policies $\{h(W), L(s, W)\}$, as well as an insurance payment function $\{q(s, W)\}$, and a provider choice policy $D(s, W)$, which satisfies three conditions:

1. Households choose $\{h(W), L(s, W), q(s, W), D(s, W)\}$ to solve problem ($P2$).
2. Private health insurance premia are actuarially fair, which implies that condition 4 holds for all wealth levels:

$$h(W) = p_1q(1, W) + p_2q(2, W)$$

3. The government budget is balanced according to 5.

Note that in this equilibrium the government does not choose the tax rate. rather, individuals choose whether to opt for freely available public health care, and the government adjusts the tax rate to finance the resulting financing needs.

In the next section we examine the first best equilibrium, in which the government has a commitment technology, and compare it with an equilibrium where the government cannot commit.

3 Equilibria with and without commitment

In this section we examine the distortions created by the role of insurer of last resort assumed by the government. We first derive the equilibrium in the case where the government can credibly commit not to provide free health care for agents who did not purchase insurance. Note that in this case the tax burden is zero, as no one will require government subsidies in equilibrium.

In the second equilibrium, agents know that they will have free access to health care provided by the government with the *Low* quality technology if

they choose to. A direct consequence is that agents will only buy private insurance if they anticipate using the privately provided *High* quality health care technology. This equilibrium allocation is then a consequence both of the effects stemming from lack of commitment and of those stemming from proportional taxation.

Equilibrium with commitment. Since we have restricted the wealth distribution so that everyone can fully insure, standard theory predicts that agents will choose full insurance, or an arrangement where no out of pocket expenditures are made under any event². Moreover, by assumption 1 nobody chooses to forgo health care if $s \in \{s_2, s_3\}$. In the context of this model, there are two identical ill states and two possible treatments for each state, so the agent's choice is limited to three distinct insurance/health care alternatives or plans:

1. Insure both states at the *High* health care technology.

$$\{h, q_2, q_3, L_2, L_3\} = \{p_2l_2 + p_3l_3, l_2, l_3, High, High\} \quad (6)$$

2. Insure state 2 at the *High* technology and state 3 at the *Low* health care technology.

$$\{h, q_2, q_3, L_2, L_3\} = \{p_2l_2 + \theta p_3l_3, l_2, \theta l_3, High, Low\} \quad (7)$$

3. Insure both states at the *Low* health care technology.

$$\{h, q_2, q_3, L_2, L_3\} = \{\theta(p_2l_2 + p_3l_3), \theta l_2, \theta l_3, Low, Low\} \quad (8)$$

With the fourth alternative being formally equivalent to alternative two above, with the identity of the two illnesses switched. The optimal choice is found by comparing the value functions under each alternative. The value functions, conditional on choosing health care treatment L_i for state i , are of the form

$$v_c(W, L_i) = u_1(W - p_2C(L_2) - p_3C(L_3)) + p_1u_2(1) + p_2u_2(2, L_2) + p_3u_2(3, L_3). \quad (9)$$

In comparing any two feasible alternatives, the tradeoffs involved in buying more insurance for a given state is that of lower utility from consumption

²The derivation of this result is standard, and left for the appendix

versus higher utility from better health care, weighted by the probability associated with the state.

The three alternatives are ranked by agents according to their wealth. In particular, as they become wealthier and since utility from consumption is concave, agents give up lower levels of utility from consumption for the same extra utility from better health care. The next lemma describes the policy function

Lemma 1 *Policy functions in the economy with commitment.*

There are three levels of wealth $\{W_0, W_1, W_2\}$ such that

$$\{h, q_2, q_3, L_2, L_3\} = \begin{cases} \{\theta(p_2l_2 + p_3l_3), \theta l_2, \theta l_3, Low, Low\} & \text{if } W \in (W_0, W_1] \\ \{p_2l_2 + \theta p_3l_3, l_2, \theta l_3, High, Low\} & \text{if } W \in (W_1, W_2] \\ \{p_2l_2 + p_3l_3, l_2, l_3, High, High\} & \text{if } W \in (W_2, +\infty) \end{cases} \quad (10)$$

Proof: see appendix A.1.

In this economy, all agents fully insure against being sick, so in equilibrium no one requires government subsidies. This implies, as mentioned above, that the government does not need to raise taxes.

Equilibrium without commitment. In the economy without commitment, agents have the choice of obtaining subsidies to use the *Low* technology after the uncertainty is resolved. The formal expression of the household problem in this case is (P2). In the case where they choose to purchase health insurance, it will always be in order to access the *High* technology, and as in the previous case they will choose to become perfectly insured. This leaves the agent with three distinct plans to compare:

1. Insure both states at the *High* health care technology.

$$\{D_2, D_3, h, q_2, q_3, L_2, L_3\} = \{0, 0, p_2l_2 + p_3l_3, l_2, l_3, High, High\} \quad (11)$$

2. Insure state 2 at the *High* technology, use the government provided *Low* health care technology for state 3.

$$\{D_2, D_3, h, q_2, q_3, L_2, L_3\} = \{0, 1, p_2l_2, l_2, 0, High, Low\} \quad (12)$$

3. Purchase no insurance, and use the government provided health care for both states.

$$\{D_2, D_3, h, q_2, q_3, L_2, L_3\} = \{1, 1, 0, 0, 0, Low, Low\} \quad (13)$$

With the fourth plan being equivalent to plan two. Again, in deciding to buy health insurance, agents will weight the costs in terms of lower utility from consumption, against the benefits in terms of higher utility from better health care. The value of using a given plan is

$$\begin{aligned} v_n(W; Plan_j) = & u_1(W(1 - \tau_n) - (1 - D_2)p_2l_2 - (1 - D_3)p_3l_3) \quad (14) \\ & + p_1u_2(1) + p_2u_2(2, L_2) \\ & + p_3u_2(3, L_3). \end{aligned}$$

The key difference between the two problems is that the lower cost of the *Low* technology in the case with commitment is a feature of the technical constraints faced by the economy, and therefore any choice of technology is by construction Pareto optimal. In the case without commitment, the *Low* technology can be accessed at zero cost because the government subsidy reduces the price faced by agents below the social cost.

Agents rank Plans 1,2 and 4 again according to wealth, with wealthier agents choosing higher quality health care. The following lemma summarizes the agents' optimal plans.

Lemma 2 *Policy functions in the economy without commitment.*

There are two levels of wealth $\{W_3, W_4\}$ such that

$$\{D_2, D_3, h, q_2, q_3, L_2, L_3\} = \begin{cases} \{1, 1, 0, 0, 0, Low, Low\} & \text{if } W \in (W_0, W_3] \\ \{0, 1, p_2l_2, l_2, 0, High, Low\} & \text{if } W \in (W_3, W_4] \\ \{0, 0, p_2l_2 + p_3l_3, l_2, l_3, High, High\} & \text{if } W \in (W_4, +\infty) \end{cases} \quad (15)$$

Proof: see appendix A.2.

We disregard the uninteresting case where $W_3 < W_0$. The government maintains a balanced budget by levying a tax at the rate τ_n .

$$\tau_n = \theta(p_2l_2 + p_3l_3) \frac{\int_0^{W_3} dG(W)}{\int_0^\infty W dG(W)} + \theta(p_3l_3) \frac{\int_{W_3}^{W_4} dG(W)}{\int_0^\infty W dG(W)} \quad (16)$$

We can now proceed to examine the distortions created by the government assuming the role of insurer of last resort. We do so by comparing the equilibria under both economies.

Comparing the two equilibria. In comparing the two economies, we will be careful to disentangle the general equilibrium effects that occur through

changes in the tax rate, from the effects that arise holding this tax rate constant and equal to zero, as in the economy with commitment. The first result characterizes the distortions in the the level of consumption vs. the amount of health insurance purchased.

Proposition 1 *Distortions in the consumption/health insurance margin*

In the equilibrium without commitment,

1. *Agents at the right end of the wealth distribution ($W > W_4$) choose a socially optimal level of expenditure in health insurance h .*
2. *Poor agents ($W < \min\{W_1, W_3\}$) are underinsured.*
3. *Agents in the middle ($W \in (\min\{W_1, W_3\}, W_4)$) may overspend or underspend in health insurance.*
4. *The tax rate effect leads to more agents being underinsured.*

Proof: *We first derive the results in partial equilibrium, where $\tau_n = 0$.*

1. *For the first claim, note that we have $W_2 < W_4$, so agents in $[W_4, +\infty)$ spend the same amount on health insurance in both economies.*
2. *For the second claim, we have $W_3 < W_1$. In the first best economy, agents in $(W_0, W_1]$ spend $\theta(l_2p_2 + l_3p_3)$ in health insurance, while in equilibrium, agents in $(W_0, W_3]$ spend nothing. Agents in $[W_0, \min(W_1, W_3))$ then underspend by an amount $\theta(l_2p_2 + l_3p_3)$.*
3. *For claim 3, if $W_3 < W_1$ and $\theta > \frac{1}{2}$, agents in $[W_3, W_1)$ will purchase too much in insurance (h) with respect to the first best.*
4. *In equilibrium, W_3 and W_4 are larger by a factor $\frac{1}{1-\tau_n}$. More agents have zero expenditures on health insurance, and fewer agents at the right end of the distribution have socially optimal levels of h . As $W_3 > W_1$, all agents with $W < W_4$ spend too little in health insurance.*

The taxonomy of over/underspending in h is shown in table 1: there is a clear pattern of underinsurance, but in case 1, individuals may spend too much in insurance if the difference between the cost of the two treatments is small ($\theta > .5$). In this case individuals choose to insure state 2 to cover *High*

quality care, and the cost of such coverage is higher than purchasing coverage for both illnesses at the *Low* quality care. Figure 2 shows expenditures in health insurance h in both economies against wealth, for the case where $W_3 < W_1$ and $\theta < .5$. Poor agents choose to rely on government provided health care in all health states, while rich agents choose high quality, privately provided health care. The next proposition describes the distortions in health care utilization

Proposition 2 *Distortions in health care utilization.*

Health care utilization is socially optimal for wealthy ($W > W_4$) and poor ($W < \min\{W_1, W_3\}$) agents, while agents in the middle (weakly) use too little quality for at least one state (s_3), but could use too much quality for the other state (s_2). The tax rate effect moves the economy in the direction of more underutilization of quality for state 3 and less overutilization for state 2.

***Proof:** In partial equilibrium, Table 2 shows the patterns of health care utilization in the cases $W_3 < W_1$ and $W_3 > W_1$. Accounting for the tax rate effect shifts W_3 to the right and therefore reduces the overutilization of quality for agents in $(W_3, W_1]$ in case 1. Eventually $W_3 > W_1$ and no overutilization occurs.*

The previous result states that health care utilization at the extremes of the wealth distribution is socially optimal, while in the middle there is a pattern of underutilization of quality for some health state, which occurs for agents with wealth just below W_4 . In our model, that the government provides free health care implies that no private insurance exists at the *Low* technology for any state, and the price distortion it creates is also responsible for the lack of private insurance at *High* quality for some agents in the middle of the wealth distribution.

It is unclear whether people in the middle of the wealth distribution use too much or too little health care quality for the poor health risk. There are two opposing effects: in the socially optimal arrangement, agents insure state 3 by an amount $\theta l_3 p_3$, so they are poorer than in the equilibrium without commitment, where they just free ride on the government services. This is an income effect that makes agents in equilibrium tend to prefer *High* quality for state 2, but then *Low* quality in state 2 is cheaper than in the economy with commitment, a substitution effect that tends to drive agents away from *High* quality health care in state 2. This result is in contrast with the underinsurance results in Coate [1995] and Bruce and Waldman [1991].

4 Conclusion

We presented a model where agents face two health risks, and must choose a level of insurance, as well as a level of health care quality for each risk. In an environment where the government takes the role of insurer of last resort, and public expenditures are financed through a proportional tax, we examined the types of distortions both in the market for private health insurance and in the provision of health care quality.

Our results suggest that the distortions regarding both the level of insurance and the demand for health care quality for each illness are concentrated at the lower end of the wealth distribution. Moreover, while the poorest individuals purchase too little insurance, their demand for health care quality is optimal. For individuals in the middle of the wealth distribution both the level of insurance and the demand for health care quality are suboptimal.

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A Appendix

A.1 Equilibrium with commitment

Standard optimization shows that in equilibrium agents choose to fully insure, so no out of pocket payments, or excess payment from the insurer, are observed. What remains is to obtain the indifference levels of wealth W_1 and W_2 . Note that the value functions under each plan are:

1. For $\{h, q_2, q_3, L_2, L_3\} = \{p_2l_2 + p_3l_3, l_2, l_3, High, High\}$:

$$v_c(W; Plan 1) = u_1(W - p_2l_2 - p_3l_3) + p_1u_2(1) + p_2u_2(2, l_2) + p_3u_2(3, l_3). \quad (17)$$

2. For $\{h, q_2, q_3, L_2, L_3\} = \{p_2l_2 + \theta p_3l_3, l_2, \theta l_3, High, Low\}$:

$$v_c(W; Plan 2) = u_1(W - p_2l_2 - \theta p_3l_3) + p_1u_2(1) + p_2u_2(2, l_2) + p_3u_2(3, \theta l_3). \quad (18)$$

3. For $\{h, q_2, q_3, L_2, L_3\} = \{\theta(p_2l_2 + p_3l_3), \theta l_2, \theta l_3, Low, Low\}$:

$$v_c(W; Plan 3) = u_1(W - \theta(p_2l_2 - p_3l_3)) + p_1u_2(1) + p_2u_2(2, \theta l_2) + p_3u_2(3, \theta l_3). \quad (19)$$

Setting the value function for plan 4 equal to that for plan 2, and solving for W , we obtain W_1 :

$$W_1 = -\frac{1}{r} \ln \frac{p_2(u_2(2, \theta l_2) - u_2(2, l_2))}{\exp(\theta r(l_2 p_2 + l_3 p_3)) - \exp(r(p_2 l_2 + \theta p_3 l_3))} \quad (20)$$

For W_2 , we set the value function for plan 1 equal to that for plan 2, and solve for W :

$$W_2 = -\frac{1}{r} \ln \frac{p_3(u_2(3, \theta l_3) - u_2(3, l_3))}{\exp(r(l_2 p_2 + \theta l_3 p_3)) - \exp(r(p_2 l_2 + p_3 l_3))} \quad (21)$$

A.2 equilibrium without commitment

The derivation is similar to the case with commitment. The value functions are:

1. For Plan 1, with $\{D_2, D_3, h, q_2, q_3, L_2, L_3\} = \{0, 0, p_2l_2 + p_3l_3, l_2, l_3, High, High\}$:

$$v_n(W; Plan 1) = u_1(W(1-\tau_n) - p_2l_2 - p_3l_3) + p_1u_2(1) + p_2u_2(2, l_2) + p_3u_2(3, l_3). \quad (22)$$

2. For Plan 2, with $\{D_2, D_3, h, q_2, q_3, L_2, L_3\} = \{0, 1, p_2l_2, l_2, 0, High, Low\}$:

$$v_n(W; Plan 2) = u_1(W(1-\tau_n) - p_2l_2) + p_1u_2(1) + p_2u_2(2, l_2) + p_3u_2(3, \theta l_3). \quad (23)$$

3. For Plan 4, with $\{D_2, D_3, h, q_2, q_3, L_2, L_3\} = \{1, 1, 0, 0, 0, Low, Low\}$:

$$v_n(W; Plan 4) = u_1(W(1 - \tau_n)) + p_1u_2(1) + p_2u_2(2, \theta l_2) + p_3u_2(3, \theta l_3). \quad (24)$$

The indifference wealth level W_3 between Plan 4 and Plan 2 is:

$$W_3 = -\frac{1}{(1 - \tau_n)r} \ln \frac{p_2(u_2(2, l_2) - u_2(2, \theta l_2))}{\exp(r l_2 p_2) - 1} \quad (25)$$

Similarly, the indifference wealth level between Plan 1 and Plan 2 is:

$$W_4 = -\frac{1}{(1 - \tau_n)r} \ln \frac{p_3(u_2(3, l_3) - u_2(3, \theta l_3))}{\exp(r(l_2 p_2 + l_3 p_3)) - \exp(r p_2 l_2)} \quad (26)$$

Table 1: Distortions in health insurance levels (h)

Case 1: $W_3 < W_1$					
	$[W_0, W_3)$	$[W_3, W_1)$	$[W_1, W_2)$	$[W_2, W_4)$	$[W_4, +\infty)$
C	$\theta(p_2l_2 + p_3l_3)$	$\theta(p_2l_2 + p_3l_3)$	$\theta p_3l_3 + p_2l_2$	$p_3l_3 + p_2l_2$	$p_3l_3 + p_2l_2$
N	0	l_2p_2	l_2p_2	l_2p_2	$l_2p_2 + l_3p_3$
	-	+ -	-	-	0
Case 2: $W_1 < W_3$					
	$[W_0, W_1)$	$[W_1, W_3)$	$[W_3, W_2)$	$[W_2, W_4)$	$[W_4, +\infty)$
C	$\theta(p_2l_2 + p_3l_3)$	$\theta p_3l_3 + p_2l_2$	$\theta p_3l_3 + p_2l_2$	$p_3l_3 + p_2l_2$	$p_3l_3 + p_2l_2$
N	0	0	l_2p_2	l_2p_2	$l_2p_2 + l_3p_3$
	-	-	-	-	0

Figure 1: Timing of events

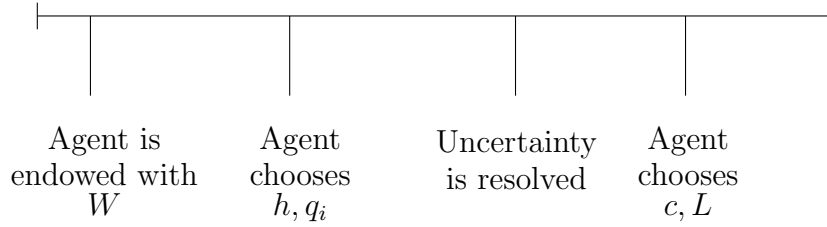


Table 2: Distortions in health care use

		Case 1: $W_3 < W_1$				
		$[W_0, W_3)$	$[W_3, W_1)$	$[W_1, W_2)$	$[W_2, W_4)$	$[W_4, +\infty)$
s_2	C	Low	Low	High	High	High
	N	Low	High	High	High	High
		+				
s_3	C	Low	Low	Low	High	High
	N	Low	Low	Low	Low	High
		-				
		Case 2: $W_1 > W_3$				
		$[W_0, W_1)$	$[W_1, W_3)$	$[W_3, W_2)$	$[W_2, W_4)$	$[W_4, +\infty)$
s_2	C	Low	High	High	High	High
	N	Low	Low	High	High	High
		-				
s_3	C	Low	Low	Low	High	High
	N	Low	Low	Low	Low	High
		-				

Figure 2: Expenditure in health insurance. Case of $W_3 < W_1$ and $\theta < .5$.

