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The Samaritan's Dilemma and public health insurance

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Abstract

When the government cannot commit to withdraw from providing charity health care, as is the case when it faces the Samaritan's Dilemma, a public health insurance scheme can be Pareto improving. However, the large heterogeneity in the design of such schemes observed around the world begs the question of what characterizes the optimal public health insurance plan. In this paper, we examine the distortions created by three plans, nested in terms of the constraints they place on the individual's decision problem. We find that linking public health insurance benefits to the use of a certain type of health care, such as treatment in public hospitals, creates incentives against the efficient use of higher quality health care. When such constraint is lifted, but the public insurance scheme still determines a minimum level of coverage for each illness, first best efficiency is achieved. It turns out that placing constraints in the form of minimum levels of coverage for each illness is necessary for efficiency. Removing such constraint decreases the relative price of high quality care for a subset of illnesses, and leads to too much high quality care used in equilibrium. This analysis suggests that the widespread practice of determining illness by illness coverage in public health insurance systems has an efficiency rationale, despite the administrative and informational difficulties that it entails.

Keywords: Samaritan's Dilemma, Health insurance.
JEL Classification Codes: H21, I18.

1 Introduction

A survey of health insurance markets across the world suggests two important regularities: first, the near universal coexistence of public health insurance with some form of private insurance. Second, the role -explicit or not- taken by the government as health care provider of last resort, which implies the free provision of some measure of health care to the poor and uninsured. Even in the US, where public insurance is targeted to the elderly trough Medicare, and the poor trough Medicaid, the government provides large subsidies for hospitals to cover what has been termed uncompensated care , the recipients of such care being mostly uninsured individuals (Hadley and Holahan [2003]).

These two observations can be readily reconciled as twin expressions of what has been termed the Samaritan's Dilemma by Buchanan [1975]: altruistic motives makes the government unable to commit *not* to provide charity care to uninsured individuals who fall ill, such inability resulting in an efficiency loss through underinsurance. When the government faces the Samaritan's Dilemma, a form of public health insurance is warranted.

A second look at the same cross section of markets however reveals a puzzling fact: there is a large heterogeneity in the design of public health insurance schemes. In particular, there are large differences in the restrictions placed on the public health insurance plan. At one end of the spectrum, Chile's public health insurance scheme is limited to mandating a minimum level of expenditure in health insurance for working individuals, with complete choice over the health plan: which illnesses are covered, etc [1]. While leaving such freedom of choice to consumers is an intriguing possibility from an academic point of view, most health insurance schemes do place restrictions on the characteristics of the health plan. In some countries, public health insurance defines minimum levels of coverage for different illnesses, but allows individuals to purchase supplementary coverage from private insurers. This is the case in the US Medicare system, where individuals can top up their insurance coverage through the privately provided Medigap health plans. Private insurance has the same supplementary role in the French health insurance system. Besides determining illness by illness coverage, as in France and the US, in many countries the insurance scheme does not allow private insurance to supplement public coverage, forcing individuals to

[1]Some restrictions in the form of minimum coverage for a few illnesses have been introduced since 2004

opt out of the coverage given by public insurance if they choose a higher quality of care. Such is the case in the Australian Medicare system, where private hospital services are covered only by private insurance. This is also the predominant arrangement in Spain, Ireland, and the UK (see Colombo and Tapay [2004] for a description of health insurance markets in OECD countries).

While the presence of the Samaritan's Dilemma suggests that public health insurance is efficiency enhancing, the questions of the efficiency properties of these different arrangements, and of the nature of the optimal public health insurance scheme, remain open. These questions provide the main motivation for our paper. In a seminal contribution, Buchanan [1975] describes the Samaritan's Dilemma problem: when an altruist will transfer resources to an individual conditional on experiencing bad luck, this individual will have reduced incentives to avoid the bad luck, or insure against it. Two contributions clarify the efficiency role of public provision in this context. Bruce and Waldman [1991] show that the government can overcome its inability to commit, and is able to achieve the first best allocation, by using transfers in kind rather than in cash. Coate [1995] extends the argument to a situation where the government can commit, but wealthy individuals care about the fate of the poor. A straightforward extension of these results to health insurance suggests that some type of public health insurance is Pareto enhancing, but we are aware of no theoretical contribution that studies the distortions created by different public health insurance schemes in the presence of the Samaritan's Dilemma.

We provide an answer to this question using a simple model with wealth/income heterogeneity and health shocks, where altruistic individuals obtain utility from consumption, their own health, and other individuals' health. The government levies taxes to finance a public health plan. We compare three such plans, indexed by the constraints they place on the nature of public health insurance, and describe their efficiency properties. The first plan, which we label Pure Public Insurance (PPI), defines levels of coverage for each illness, and ties public insurance benefits to the use of low quality health care, mimicking the scheme in place in a number of developing countries. The second plan, labelled Public Insurance with Plan Choice (PIPC), removes the link between public insurance benefits and health care demand, by allowing for the purchase of extra insurance. The third scheme we consider, Mandated Insurance (MI), limits the public health plan to imposing a minimum amount of expenditure in health insurance, leaving the choice of the levels of coverage for each illness to the individual.

Adverse selection is often put forward as an alternative argument to explain the near universality of public health insurance schemes. In our model, public health insurance can be Pareto enhancing without resorting to unobserved differences in risk, so in the name of simplicity we avoid introducing such heterogeneity, leaving the the question of the interaction between Samaritan's Dilemma and adverse selection motivated behavior for future work.

Our results can be summarized as follows. A PPI scheme increases the relative price of high versus low quality health care, resulting in underutilization of quality relative to the first best. At the other end of the spectrum, a MI scheme reduces the relative price of high versus low health care quality from the first best benchmark, resulting in too much quality used in equilibrium. A PIPC scheme, where the government sets minimum levels of coverage for each illness, while allowing for the purchase of extra coverage, creates no relative price distortions, and hence achieves the first best. An important lesson from the analysis is that imposing minimum levels of coverage for each illness is necessary for optimality of a public health insurance plan. We provide in this sense an efficiency rationale for the widespread existence of such constraints, despite the large administrative costs and information requirements that they imply.

The paper has three other sections. Section two presents the model and the alternative health insurance schemes, and describes the equilibrium concept. Section three describes the planner's problem, derives the equilibria and describes the distortions created by each arrangement. Section four 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. Individuals derive utility from their own consumption and health, and other individuals' health, and may use health care to moderate the utility loss from negative health shocks. 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 from the government providing a minimum level of free health care to the uninsured.

Health risks and health care technology. We let s_i denote health state i with $s = \{s_1, s_2, s_3\}$ being the set of health states. The state s_1 represents good health, and s_2 and s_3 two different illnesses. We assume that both illnesses have the same associated probabilities ($p_2 = p_3$) and costs ($C(L_2) = C(L_3)$): this benchmark aims to make clear that our arguments are not dependent on extreme assumptions about s_2 and s_3. The probabilities associated to these health states are $\{p_1, p_2, p_3\}$, and when there is no scope for ambiguity we use the index i to refer to states s_2 or s_3. Health care is produced at a cost 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 $i = 2, 3$. 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, this quality difference reflecting purely technical differences in the treatments [2].

The market for insurance. There is free entry in the market for health insurance and therefore firms earn zero profits. We label h^g the level of government provided insurance and h^p the level of private insurance, and use the same superscripts for the contingent payments q_i. We assume that the government purchases insurance cover at market rates. Since there are no costs of selling insurance, premia are actuarially fair. This implies

$$h^p = p_2 q_2^p + p_3 q_3^p \quad (1)$$

$$h^g = p_2 q_2^g + p_3 q_3^g \quad (2)$$

[2] As opposed to reflecting lack of choice, waiting times, etc, as this would cloud the relationship between social cost and utility from the treatment.

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

Endowments. Agents are endowed with a wealth level W at the beginning of the period, with wealth following the distribution $G(W)$ with support $[\underline{W}, +\infty) \equiv [\theta(l_2 p_2 + l_3 p_3), +\infty)$. The lower bound $\underline{W}$ 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 allocations. The issue of what are the best health insurance policies for individuals below $\underline{W}$ is somewhat uninteresting in this setup, as such policies would invariably involve subsidies.

The government. The government taxes individuals an amount $\tau = \theta(p_2 l_2 + p_3 l_3)$, or $2\theta l_i p_i$. This amount is sufficient to provide public insurance that covers *Low* quality health care for both illnesses, if such policy is chosen. The government uses the tax to purchase health insurance (h^g), and returns the difference in cash (T_1), so that

$$T_1 = \tau - h^g \tag{3}$$

Equation (3) implies no cross subsidization. Rather than focusing on the question of optimal redistribution, we focus on the nature of the optimal health insurance arrangements.

A government policy consists of three elements, besides the tax τ. The first is an explicit insurance plan, given by constraints on $\{h^g, q_i^g\}$, and financed by the tax. The second element is an unconditional transfer T_1, and the third is a set of conditional transfers T_2^i for states $i \in \{2, 3\}$. Both the insurance plan and the transfers are functions of wealth.

The government budget constraint for individual j is then

$$\tau = T_1(W_j) + h^g(W_j) + T_2(W_j)I_{[s_2]} + T_3(W_j)I_{[s_3]} \tag{4}$$

Where $I_{[s_i]}$ is an indicator function equal to one if the individual is in state s_i and decides to request a conditional transfer. Note that, by 3 this constraint is satisfied only if conditional transfers are equal to zero. In our model, the demand for conditional transfers to finance *Low* quality health care reveals a failure of government policy to either provide explicit public insurance or induce individuals to purchase private insurance.

Preferences. Individual j derives utility from consumption (u_1^j) and her own health (u_2^j), as well as other individuals' health ($u_2^{j'}$), and rank choices according to expected utility

$$U^j = \sum_{i=1}^{3} p_i \{u_1^j(c_i) + u_2^j(s_i, L_i)\} + \min_{j'}\{u_2^{j'}(s_i, L_i)\} \tag{5}$$

Where the third term indicates the utility from health for the worst off individual -in terms of health and health care used- in the population. In what follows we omit the superscripts to obtain a more concise notation. To understand the role played by this term, note that in order for a commitment problem to arise, a measure of altruism is necessary. Here the altruism takes the form of caring for the health of the least fortunate. This Rawlsian feature of preferences implies that the role of public health insurance will be to provide a safety net against health shocks, ensuring a minimum standard of care for everyone. We believe that this is indeed the role assigned to public health insurance in most countries.

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:

$$u_1(c_i) = -exp(-rc_i). \tag{6}$$

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 motivated heuristically 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 s_2 or s_3 with $L = 0$ has an infinitely large compensating variation with respect to being in the same state with Low quality health care. For $i \in \{2, 3\}$:*

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

Note that in the current framework the externality created by the ill individuals with the lowest level of health care treatment implies that, even if it is privately optimal to forgo any treatment, the planner may still choose to subsidize health care. We use the above assumption to rule out this possibility, as it would divert us from the central question of the optimal health insurance arrangements in the presence of the Samaritan's Dilemma.

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

$$c_i = W - h^g - h^p - C(L_i) + q_i \tag{7}$$

Where W represents wealth and $h^g = \tau - T_1$ by condition (3) above. When healthy, it is understood that $\{L_1, C(L_1)\} = \{0, 0\}$, which implies $q_1 = 0$, so consumption is just $c_1 = W - h^g - h^p$.

Timing. Two sets of decisions are made by individuals. Before the uncertainty is resolved, agents are endowed with a wealth level W, pay a tax τ and receive a cash transfer T_1. At this time the government announces the rules of the public health system in place, given by constraints on $\{h^g, q_i^g\}$. Individuals then choose simultaneously a level of private health insurance h^p, as well as insurance payments q_2^p and q_3^p. After the uncertainty is resolved, agents choose a level of consumption c and make health care choices L_i, possibly receiving a government transfer T_2^i in the form of health care. This timing of events is displayed in Figure 1.

Health insurance arrangements. We first consider an economy where the government can commit, and use it as a benchmark. We compare three health insurance arrangements to this benchmark, each of them placing successively fewer constraints on the nature of the health insurance scheme:

1. Commitment (C).
   In an economy with commitment, there is no need for transfers in the form of health insurance, so the government sets $T_1 = \tau$. The household chooses consumption, health insurance and health care to solve

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

Where we omit the min term in the objective function, as it does not affect the household's choices. A solution to this problem are policy functions for consumption $c : s \times \mathbb{R}^+ \to \mathbb{R}^+$; for the level of insurance $h^p : \mathbb{R}^+ \to \mathbb{R}^+$; for insurance payments $q^p : s \times \mathbb{R}^+ \to \mathbb{R}^+$ and for health care treatment $L : s \times \mathbb{R}^+ \to \{0, Low, High\}$.

2. Pure Public Insurance (PPI).
   In this case the insurance arrangement determines a level of public insurance (h^g), with predetermined coverage (q_2^g and q_3^g) for the different health states. Moreover, individuals can only use the insurance plan to purchase *Low* quality health care, so the plan gives no choice of purchasing extra insurance to access higher quality health care. The individual can however privately insure one or both ill states in order to access *High* quality health care, but she will bear the full costs of this insurance plan.

   The household problem in an economy with PPI is given by:

$$\max_{h^p, q_i, q_i^p, c_i, L_i, T_2^i} \quad p_1(u_1(c_1) + u_2(s_1)) + p_2(u_1(c_2) + u_2(s_2, L_2)) \tag{8}$$

$$+p_3(u_1(c_3) + u_2(s_3, L_3)) \tag{P2}$$

$$s.t. \quad c_i = W - h^g - h^p - C(L_i) + q_i + T_2^i \text{ for } i = 1, 2, 3 \tag{9}$$

$$h^p = p_2 q_2^p + p_3 q_3^p \tag{10}$$

$$h^g > 0 \; given \tag{11}$$

$$q_i^g \; given \tag{12}$$

$$q_i = \begin{cases} q_i^g & \text{if } L_i = Low \\ q_i^p & \text{if } L_i = High \end{cases} \tag{13}$$

   Expressions (8) to (10) are otherwise equivalent to problem ($P1$), but the constraints (11) to (13) characterize the household problem under PPI. The solution is given by policy functions for $\{h^p, q_i, q_i^p, c_i, L_i\}$ above plus a function $T_2 : s \times \mathbb{R}^+ \to \mathbb{R}$ that maps a state and a level of insurance coverage to a level of conditional transfers requested. Note that the choice of L_i is both a choice of health care quality and a choice of whether to use privately provided health care ($L_i = High$), or free publicly provided health care ($L_i = Low$). Constraint (11) sets the minimum level of expenditure in health insurance to h^g, while (13) links public insurance to *Low* quality health care.

This public insurance arrangement captures the nature of most insurance systems in OECD countries. This arrangement is also common in developing countries, where it takes the form of linking public insurance to the use of public hospitals and health care centers.

3. Public insurance with plan choice (PIPC).
In this case the insurance arrangement determines a minimum level of insurance given by h^g, as well as the plan (q_2^g and q_3^g) that will be purchased with this insurance level. As opposed to the previous arrangement, individuals can purchase extra insurance to access higher quality health care. This plan gives individuals a minimum level of coverage, but leaves them the choice of purchasing different levels of health care quality without having to opt out of the public insurance arrangement.

   The household problem in this case is given by (P2), with conditions (11) to (13) replaced by :

$$\begin{aligned} h^g &> 0 \; given & (14) \\ q_i^g & \quad given & (15) \\ q_i &= q_i^g + q_i^p & (16) \end{aligned}$$

   Constraints (14) and (15) are also present in (P2). Constraint (16) says that extra coverage can be purchased on top of public insurance coverage.

   As discussed in the introduction, this health insurance system captures the main features of the Medicare plan in the US, and the public health insurance system in France. These features are also part of the plan characteristics in the universal health insurance proposal by Mark Pauly and coauthors in Pauly et al. [1991]:

   > All insurance plans must provide at least the minimum benefits specified by the government...
   >
   > A plan could offer benefits beyond the required minimum [...] with an additional premium charge, for those consumers preferring more extensive coverage.

4. Mandated insurance (MI).
With mandated insurance, the government sets a minimum level of

insurance, but individuals are free to choose different plans (q_i's), as well as to purchase extra coverage. Individuals are also free to choose different levels of health care quality to be covered by the insurance plan.

The household problem in this economy is given by (P2) with conditions (11) to (13) replaced by a single constraint that requires the level of insurance to be above a minimum:

$$h^g > 0 \ given \tag{17}$$

This arrangement is currently in place in Chile, and a number of European countries, by giving individuals a choice of plans, are advancing in this direction (see Kerssens and Groenewegen [2005] for an account of this trend).

In the light of this discussion, the three arrangements described above can be seen as being nested in terms of the constraints they place on the public health plan offered: note that PIPC and PPI are clearly nested in MI, as the restrictions MI places on the public insurance scheme is a subset of those that characterize the other two arrangements. Then, PPI is also nested in PIPC, as individuals who can reach a health care bundle $\{L_2, L_3\}$ with PPI can also reach it with PIPC, but the inverse does not hold. Figure 2 illustrates this observation: it shows the consumption possibilities for an individual who chooses complete insurance given a bundle of health care qualities. From an individual point of view, MI is always weakly preferred to PIPC, which in turn is weakly preferred to PPI.

When studying the welfare implications of these three arrangements, we are then interested in what set of constraints in the public health insurance arrangement allow the government to minimize the distortions caused by the its inability to commit.

The nature of the equilibrium is that of a standard competitive equilibrium, where we impose that the government cannot deny a minimum level of health care to all those who require it, and at the same time runs a balanced budget on an individual basis. The first requirement, which we take as given here, will be formally motivated by efficiency arguments in the next section. We define an equilibrium for the case of PPI, the extension to the remaining arrangements being straightforward.

Equilibrium. An equilibrium for the economy with PPI is a set of transfer functions $\{T_1(W), T_2^2(W), T_2^3(W)\}$, a public health scheme $\{h^g(W), q_i^g(s, W)\}$, insurance and health care optimal policies $\{h^p(W), L(s,W)\}$, an optimal policy for consumption $c(s,W)$, as well as an insurance payment function $q^p(s,W)$, and a provider choice policy $D(s,W)$, which satisfies three conditions:

1. Given $\{T_1(W)\}$ and $\{h^g(W), q_i^g(s,W)\}$, households choose $\{h^p(W), L(s,W), q^p(s,W), D(s,W), T_2(s,W)\}$ to solve problem $(P2)$.

2. Private health insurance premia are actuarially fair, which implies that conditions 1 and 2 hold for all wealth levels:

$$h^p(W) = p_1 q^p(1,W) + p_2 q^p(2,W)$$

$$h^g(W) = p_1 q^g(1,W) + p_2 q^g(2,W)$$

3. The government budget is balanced with respect to each household, which implies $T_2(s,W) = 0$:

$$\tau = T_1(W) + h^g(W)$$

The government can be seen as playing a Stackelberg game with individuals. After announcing the insurance plan and the unconditional transfer, individuals make decisions on consumption and the purchase of private health insurance. After the uncertainty is revealed, individuals make decisions on health care, possibly including requesting conditional transfers in the form of health care if ill. The government then incorporates individual demand functions into the design of the public policy, so that the public insurance plan satisfies: (1) Both illnesses are covered by public or private insurance, which covers at least *Low* quality health care, and (2) Public insurance is not redundant to the individual. The first condition implies that conditional transfers (T_2^i) are not used in equilibrium. The second condition is a consequence of the no profit condition (2).

In this equilibrium definition, the government policy is constrained only by the requirement of budget balance and the no profit condition 2, which amounts to the transfers being an equilibrium of the Stackelberg game described above. In the next section, we study the optimal policies for the three health insurance arrangements, and compare the equilibrium allocations they induce to the first best allocation

3 Welfare implications of health insurance arrangements

As discussed in the previous section, the planner does not have recourse to transferring resources across individuals. This allows to focus on the question of the optimal health insurance scheme. For concreteness, we may think of the planner as maximizing a social welfare function that gives the same weight to all individuals:

$$\begin{aligned} SW &= \int U dG \\ &\int (\sum_{i=1}^{3} p_i \{u_1^j(c_i) + u_2^j(s_i, L_i)\}) dG + \min_{j'} \{u_2(s_i, L_i)\} \end{aligned} \tag{18}$$

That individuals care about the worst off in terms of health care utilization motivates the planner to ensure that no one goes without a minimum standard of treatment if sick. Note that since we do not allow for redistribution, and the poorest agents can barely afford insurance that covers the *Low* quality treatment, the planner cannot achieve the goal that all individuals access the *High* quality treatment. To summarize, in this framework the role of altruism is reduced to giving the planner the constraint that everyone must be guaranteed a minimum standard of health care -in our case *Low* quality care- and the government's inability to commit stems directly from it. A number of public health insurance arrangements meet this constraint, each of which induces different distortions. The role of the planner is then to choose the arrangement that minimizes these distortions.

We begin by describing the general features of the equilibrium, which are shared by all economies. Since utility is concave, and insurance premia are actuarially fair, individuals will always choose complete insurance, be it explicit through public or private insurance, or implicit through conditional in kind transfers. This implies that no out of pocket expenditures are made on health care in any state of nature. Health care is a normal good, so the poorest individuals, up to a given wealth level, will choose to use a *Low* quality of health care in both ill states of nature, while individuals from this level to a second wealth level will choose insurance to cover *High* quality health care in one state, which without loss of generality we take to be state s_2, and *Low* quality in the other state. Wealthier individuals choose insurance to cover *High* quality health care in both ill states of nature. These two margins can be characterized by the choice of $\{L_2, L_3\}$. We will label them the low quality margin ($\{Low, Low\}$ vs. $\{High, Low\}$), and the high quality margin ($\{High, Low\}$ vs. $\{High, High\}$).

Equilibrium with commitment. Given the discussion in the previous paragraph, the equilibrium allocation is completely characterized by the health care demands $\{L_2, L_3\}$. In the case where the government can commit not to give conditional transfers, it is optimal to return the entire tax receipt as an unconditional cash transfer, so $T_1 = \tau$. In this case the demands for health care are

$$\{L_2, L_3\} = \begin{cases} \{Low, Low\} & \text{if } W \in [\underline{W}, W_1) \\ \{High, Low\} & \text{if } W \in [W_1, W_2) \\ \{High, High\} & \text{if } W \in [W_2, +\infty) \end{cases} \tag{19}$$

With the indifference levels of wealth given by

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

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

The derivation of this equilibrium is straightforward and left for appendix A.

Equilibrium under Pure Public Insurance. As discussed in the previous section, in this arrangement individuals must opt out of public insurance if they want to access *High* quality health care for a given illness. Lack of commitment implies that, if they anticipate choosing a *Low* quality treatment for a given state, they will have no incentive to purchase insurance against it.

Considering that the planner aims to reproduce the allocation in the economy with commitment, it will offer different insurance packages to individuals with different wealth levels. The problem faced by the planner in trying to induce the first best allocation is that, since the price of *Low* quality care is now zero, individuals at the margins will be induced to substitute *High* quality for *Low* quality, given that the balanced budget rule in 4 prevents an income effect.

The problem of inducing the allocation in (19) is that of inducing individuals to be indifferent between the choices $\{Low, Low\}$ and $\{Low, High\}$ at the wealth level W_1, and between the choices $\{Low, High\}$ and $\{High, High\}$ at the wealth level W_2.

In order to induce individuals to switch health care demands from $\{Low, Low\}$ to $\{High, Low\}$, the government uses two sets of transfer and health insurance policies aimed at individuals with different wealth levels. The first policy is to set $T_1 = 0$ and $\{h^g, q_2^g, q_3^g\} = \{2\theta l_i p_i, \theta l_i, \theta l_i\}$ for poorer individuals, so that public insurance covers health care at the Low quality for both ill states. In equilibrium, an individual who receives such transfer will demand Low quality in both states s_2 and s_3, or otherwise the no profit condition (2) will be violated. The second policy is to set $T_1 = \theta l_2$ and $\{h^g, q_2^g, q_3^g\} = \{\theta l_i p_i, 0, \theta l_i\}$ for individuals above a threshold, and aims to induce the utilization of $High$ quality health care for one of the states, which we take to be state s_2. If faced with this policy an individual rather demands $\{L_2, L_3\} = \{High, High\}$, the no profit condition -condition 2 in the equilibrium definition- is violated; if $\{L_2, L_3\} = \{Low, Low\}$, the government will run a budget deficit, violating condition 3 of the equilibrium definition.

The first transfer and public insurance policy induces behavior consistent with the equilibrium for individuals with wealth lower than a cutoff level, which we call $\overline{W}_1^{PPI}$, while the second transfer policy induces equilibrium behavior for individuals with wealth higher than a second cutoff level, which we call $\underline{W}_1^{PPI}$. While $\underline{W}_1^{PPI}$ is smaller than $\overline{W}_1^{PPI}$, so that the policy switch can be implemented over some wealth range, we have

$$W_1 < \underline{W}_1^{PPI} < \overline{W}_1^{PPI}. \tag{22}$$

This condition implies that the planner cannot achieve the first best allocation on this margin. The best it can do is to implement the first transfer policy to individuals with wealth in $[\underline{W}, \underline{W}_1^{PPI})$, and the second transfer policy to individuals with wealth $\underline{W}_1^{PPI}$ and higher, up to a second cutoff level yet to be defined.

To induce individuals to switch health care demands from $\{High, Low\}$ to $\{High, High\}$, the planner faces a similar problem. In this case, a policy $\{T_1, h^g, q_2^g, q_3^g\} = \{\theta l_i, \theta l_i, 0, \theta l_i\}$ will induce individuals with wealth below $\overline{W}_2^{PPI}$ to demand $\{High, Low\}$, while a policy $\{T_1, h^g, q_2^g, q_3^g\} = \{2\theta l_i p_i, 0, 0, 0\}$ will induce individuals with wealth higher than a cutoff level $\underline{W}_2^{PPI}$ to demand $\{High, High\}$, with

$$W_2 < \underline{W}_2^{PPI} < \overline{W}_2^{PPI}. \tag{23}$$

Again, only second best optimality can be achieved at this margin, and it is done by switching policies at the level $\underline{W}_2^{PPI}$, defined below. The optimal equilibrium public policies in this arrangement are

$$\{T_1, h^g, q_2^g, q_3^g\} = \begin{cases} \{0, 2\theta l_i p_i, \theta l_i, \theta l_i\} & \text{if } W \in [\underline{W}, \underline{W}_1^{PPI}) \\ \{\theta l_i p_i, \theta l_i p_i, 0, \theta l_i\} & \text{if } W \in [\underline{W}_1^{PPI}, \underline{W}_2^{PPI}) \\ \{2\theta l_i p_i, 0, 0, 0\} & \text{if } W \in [\underline{W}_2^{PPI}, +\infty) \end{cases} \tag{24}$$

This transfer and public health insurance policy induces the following policy functions for health insurance and health care use:

$$\{h^p, q_2^p, q_3^p\} = \begin{cases} \{0, 0, 0\} & \text{if } W \in [\underline{W}, \underline{W}_1^{PPI}) \\ \{l_i p_i, l_i, 0\} & \text{if } W \in [\underline{W}_1^{PPI}, \underline{W}_2^{PPI}) \\ \{2 l_i p_i, l_i, l_i\} & \text{if } W \in [\underline{W}_2^{PPI}, +\infty) \end{cases} \tag{25}$$

$$\{L_2, L_3\} = \begin{cases} \{Low, Low\} & \text{if } W \in [\underline{W}, \underline{W}_1^{PPI}) \\ \{High, Low\} & \text{if } W \in [\underline{W}_1^{PPI}, \underline{W}_2^{PPI}) \\ \{High, High\} & \text{if } W \in [\underline{W}_2^{PPI}, +\infty) \end{cases} \tag{26}$$

With the cutoff points given by

$$\underline{W}_1^{PPI} = \frac{1}{r} \ln \frac{\exp(\theta r l_i p_i)(\exp(r l_i p_i) - 1)}{p_2(u_2(2, \theta l_2) - u_2(2, l_2))} \tag{27}$$

$$\underline{W}_2^{PPI} = \frac{1}{r} \ln \frac{\exp(r l_i p_i)(\exp(r l_i p_i) - 1)}{p_3(u_2(3, \theta l_3) - u_2(3, l_3))} \tag{28}$$

Table 1 compares the optimal PPI equilibrium to the equilibrium with commitment. Note that it has the same structure as that under commitment, but displays underinsurance at both the low and high quality margins. The following proposition summarizes the welfare implications of implementing an optimal PPI arrangement.

Proposition 1 *An optimal Pure Public Insurance scheme is not first best efficient. Moreover, it results in underinsurance and underutilization of quality at both margins.*

Proof: Follows from inequalities (22) and (23)

Note that the failure of this arrangement to attain the first best allocation is a direct consequence of individuals facing a distorted relative price of *High* versus *Low* health care. Such distortion occurs precisely because with PPI individuals have to opt out of the public insurance scheme in order to access higher quality care, and therefore the price of *High* quality relative to *Low* quality is higher than in the economy with commitment.

Because the result in proposition 1 hinges entirely on the opting out feature of PPI, it is robust to the inclusion of more than two health care qualities. At the limit, with an unbounded continuum of qualities, every individual up to a threshold would choose to rely on public insurance for at least one illness, and consume different levels of quality for the other. Wealthier individuals would rely on private insurance for both illnesses, demanding levels of quality in accord to their means. By the same token, extending the model to more than two illnesses would deliver no further insights.

Equilibrium under Public Insurance with Plan Choice. Under PIPC individuals have a minimum level of coverage $q_i^g = \theta l_i$ for each illness ($i = 2, 3$), but may access higher quality health care by purchasing extra coverage. Under this arrangement, once *Low* quality care is covered the marginal cost of purchasing insurance to cover *High* quality health care is $(1-\theta)l_i$ for state s_i, which is the same marginal cost faced by individuals in the economy with commitment. Since PIPC does not distort relative prices, it is expected that the equilibrium is first best efficient.

Proposition 2 *An optimal Public Insurance with Plan Choice scheme attains the first best allocation.*

Proof: Omitting the min *term in the utility function, the household problem can be stated as*

$$\max_{h^p, q_i, q_i^p, c_i, L_i, T_2^i} \quad p_1(u_1(c_1) + u_2(s_1)) + p_2(u_1(c_2) + u_2(s_2, L_2)) \qquad (P3)(29)$$

$$+p_3(u_1(c_3) + u_2(s_3, L_3))$$

$$s.t. \quad c_i = W - h^g - h^p - C(L_i) + q_i + T_2^i \ for\ i = 1, 2, 3 \qquad (30)$$

$$h^p = p_2 q_2^p + p_3 q_3^p \qquad (31)$$

$$h^g > 0 \ given \qquad (32)$$

$$q_i \geq q_i^g, q_i^g \ given \qquad (33)$$

$$q_i = q_i^g + q_i^p \qquad (34)$$

With the policy $q_i^g = \theta l_i$. *Since in the first best allocation no individual chooses* $q_i < \theta l_i$ *for* $i \in \{2, 3\}$, *the constraint (33) will not be binding. Straightforward relabelling shows that the problem faced by individuals is the same as in the economy with commitment.*

Although this arrangement is first best efficient, in practice it requires from the planner detailed knowledge of what constitutes a minimum standard of care for each single illness. In this sense it would desirable to obtain the same efficiency result with an arrangement that places fewer restrictions on the nature of the insurance scheme, such as the MI scheme.

Equilibrium under Mandated Insurance. Under MI individuals are constrained to a minimum level of aggregate insurance h^g which they can use to purchase a plan $\{q_2^g, q_3^g\}$ of their choice, subject to the no profit constraint in (2). Individuals can also purchase insurance in excess of this minimum. We assume that insurance plans cannot give cash handouts, so if h^g covers in excess of l_i for $i \in \{2, 3\}$, the remaining amount is destined to cover the other ill state. Departing from the assumptions in the previous health insurance arrangements, in this setting the planner can mandate an h^g above that which covers *Low* quality care for both ill states. As will become clear below, no equilibrium exists if the planner is constrained to setting $h^g = 2\theta l_i p_i$. [3]

The difficulty faced by the planner in setting the optimal levels of h^g is that individuals, knowing that they can access *Low* quality care for free, will prefer to devote the entire amount of mandated insurance to cover *High* quality care for one state, up to the cost of such treatment, and obtain (partial) subsidies through T_2 for the other, rather than insuring both ill states equally.

At the high quality margin the planner faces no free riding problem when inducing individuals to demand efficient levels of insurance and health care quality. The planner can ensure efficiency at this margin by mandating $h^g = 2l_i p_i$ for individuals with wealth higher than W_2, and $h^g = (1 + \theta)l_i p_i$ for individuals with wealth (marginally) lower than W_2. This feature of the solution is clearly driven by health care quality being a discreet choice. With a continuum of qualities, individuals will always be tempted to demand too much quality with respect to the first best, as is the case here at the low quality margin.

At the margin between $\{Low, Low\}$ and $\{High, Low\}$, the planner will face the problem discussed above: while it can induce individuals in $[W_1, W_2)$ to purchase an efficient insurance plan that covers $\{High, Low\}$, in order to induce those with wealth lower than W_1 to demand $\{Low, Low\}$ it is constrained to set $h^g = 2\theta l_i p_i$. If the planner mandates $h^g < 2\theta l_i p_i$, individuals will have no incentives to purchase extra insurance to cover $\{Low, Low\}$ [4].

[3] Here we use the notation h^g to denote the minimum mandated health insurance, and h^p to denote supplemental insurance.

[4] The planner could induce $\{Low, Low\}$ health care utilization by setting $h^g = 0$ and

If it mandates $h^g > 2\theta l_i p_i$ and individuals choose $\{Low, Low\}$, there will be too much coverage of at least one state. In this case, where the government mandates $h^g = 2\theta l_i p_i$, individuals will prefer to insure both ill states to cover *Low* quality care only if this provides higher utility than ensuring one state to cover *High* quality care:

$$\begin{aligned} u_1(W - 2\theta l_i p_i) + p_2 u_2(s_2, Low) + p_3 u_2(s_3, Low) \quad &\geq \\ u_1(W - \max\{2\theta l_i p_i, l_i p_i\}) + p_2 u_2(s_2, High) + p_3 u_2(s_3, Low) & \end{aligned} \tag{35}$$

If the cost difference between *Low* and *High* quality is small enough, so that $2\theta > 1$, the mandated minimum insurance will be sufficient to purchase coverage for *High* quality care in one state of nature, and everyone will choose $\{q_2, q_3\} = \{l_i, 2\theta l_i - l_i\}$ and $\{L_2, L_3\} = \{High, Low\}$. If this condition is not met, individuals with wealth higher than a critical level W_1^{MI} will choose to purchase extra insurance above h^g to cover *High* quality care for one of the ill states, and leave the other state uninsured. The expression for W_1^{MI} is

$$W_1^{MI} = \frac{1}{r} \ln \frac{\exp(r l_i p_i) - \exp(r 2\theta l_i p_i)}{p_2(u_2(s_2, High) - u_2(s_2, Low))}. \tag{36}$$

With $W_1^{MI} < W_1$, so in neither case ($\theta > \frac{1}{2}$ or $\theta \leq \frac{1}{2}$) the planner can induce individuals to insure efficiently at this margin. Summarizing, the optimal public policy with MI are

$$h^g = \begin{cases} 2\theta l_i p_i & \text{if } W \in [\underline{W}, W_1^{MI}) \\ (1+\theta) l_i p_i & \text{if } W \in [W_1^{MI}, W_2) \\ 2 l_i p_i & \text{if } W \in [W_2, +\infty) \end{cases} \tag{37}$$

This public policy induces the following policy functions for private insurance and health care demand:

$$\{h^p, q_2^g + q_2^g, q_3^g + q_3^g\} = \begin{cases} \{0, \theta l_i, \theta l_i\} & \text{if } W \in [\underline{W}, W_1^{MI}) \\ \{0, l_i, \theta l_i\} & \text{if } W \in [W_1^{MI}, W_2) \\ \{0, l_i, l_i\} & \text{if } W \in [W_2, +\infty) \end{cases} \tag{38}$$

$$\{L_2, L_3\} = \begin{cases} \{Low, Low\} & \text{if } W \in [\underline{W}, \underline{W}_1^{MI}) \\ \{High, Low\} & \text{if } W \in [\underline{W}_1^{MI}, W_2) \\ \{High, High\} & \text{if } W \in [W_2, +\infty) \end{cases} \tag{39}$$

relying on conditional transfers, but a policy of conditional transfers is effectively a policy where the government provides insurance, and we are interested in whether mandated insurance alone can implement the first best and free the government from taking the role of insurer of last resort

Table 2 compares the MI equilibrium to the first best equilibrium. As with PPI, MI is socially inefficient, but the distortions it creates are in the form of too much insurance for some states, and with it the consumption of too much health care quality, as opposed to the general result of underinsurance in the PPI arrangement. This is formalized in the following proposition

Proposition 3 *An optimal public insurance scheme with Mandated Insurance is not first best efficient: it induces too much insurance and quality utilization at the low quality margin.*

Proof: The formal derivation of the equilibrium is left for appendix A. It is sufficient to note that the equilibrium health care demands have the same structure as in the economy with commitment, but with a lower cutoff point at the low quality margin, as $W_1^{MI} < W_1$.

By allowing individuals to choose the mix of states to be insured, while keeping the government's role of provider of free *Low* quality health care, MI provides incentives to individuals to purchase high levels of coverage for selected states at no marginal cost, effectively reducing the relative price of *High* versus *Low* health care quality for those states. Note that the discreetness of both the number of illnesses and qualities of care does not play any role in proposition 3. In this sense, the result in this proposition is robust to extending the model on both these dimensions.

The phenomenon described here is widely observed in Chile, where privately insured individuals tend to switch to the public insurer, which has an open door policy, in the presence of catastrophic, high deductible illnesses. This switching behavior implies that such illnesses are de facto not covered by private insurers, so the entire amount of mandated insurance is devoted to cover the set of remaining illnesses.

4 Conclusions

In a model where individuals are altruistic towards other individuals' health, and therefore public health insurance is a Pareto improving institution, we examined the distortions created by different constraints imposed on the public health insurance scheme. Our findings suggest that constraints that link public health insurance benefits to the use of a certain type of health care, as is the case in a number of insurance schemes in developing countries, creates incentives against the efficient use of higher quality health care. If such constraint is lifted, but the public insurance scheme still determines a minimum level of coverage for each illness, first best efficiency is achieved. It turns out that defining minimum levels of coverage for each illness is actually necessary for efficiency, as removing such constraint leads, as in the case of Mandated Insurance, to too much high quality care used in equilibrium. Our analysis suggests then an efficiency rationale for the widespread determination of illness by illness coverage in public health insurance systems, despite the administrative and informational difficulties that it entails.

The analysis presented here is a necessary first step towards understanding the wide diversity of public health insurance arrangements observed across countries. In this simple framework, a number of extensions have been left for future work. An important question left for future work relates to the design of efficient health insurance schemes when there is unobserved cross sectional heterogeneity in health risks. We can only speculate that, with unobserved heterogeneity in risks, mandated insurance may become an appealing alternative, as it would allow different individuals to purchase different health plans. Such efficiency gains would then have to be weighted against the efficiency losses discussed in this paper.

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A Derivation of equilibria

In this appendix we derive the equilibria in the economies with commitment, PPI and MI.

A.1 Commitment

We first derive the standard result that $q_i = C(L_i)$. The first order conditions with respect to q_2 and q_3 are:

$$(q_2) \quad p_1(-p_2)u_1'(c_1) + p_2(1-p_2)u_1'(c_2) + p_3(-p_2)u_1'(c_3) = 0 \tag{40}$$
$$(q_3) \quad p_1(-p_3)u_1'(c_1) + p_2(-p_3)u_1'(c_2) + p_3(1-p_3)u_1'(c_3) = 0 \tag{41}$$

After some algebra we obtain $u_1'(c_2) = u_1'(c_3)$, which implies $c_2 = c_3$. Using this last expression in the FOC for (q_2) to eliminate c_2 yields $c_1 = c_3$, so consumption is smoothed across states of nature. From the budget constraints we then obtain

$$q_i = C(L_i) \tag{42}$$

From the no profit conditions we have $h = p_2C(L_2) + p_3C(L_3)$. Indirect utility can then be expressed as a function of L_i and W:

$$v(L_2, L_3; W) = u_1(W - p_2C(L_2) - p_3C(L_3)) + p_1u_2(s_1) + p_2u_2(s_2, L_2) + p_3u_2(s_3, L_3) \tag{43}$$

At the low quality margin, the household chooses between $\{L_2, L_3\} = \{Low, Low\}$ and $\{High, Low\}$. At the wealth level W_1 the household is indifferent between either choice, so W_1 can be obtained by solving:

$$v(Low, Low; W_1) = v(High, Low; W_1) \tag{44}$$

Similarly, W_2 can be obtained by solving

$$v(High, Low; W_2) = v(High, High; W_2) \tag{45}$$

A.2 Pure Public Insurance

A.2.1 Low quality margin

1. When the government announces $\{T_1, h, q_i\} = \{0, 2\theta l_ip_i, \theta l_ip_i\}$, individuals will choose $\{L_2, L_3\} = \{Low, Low\}$ if

$$u_1(W - 2\theta l_ip_i) + p_1u_2(s_1) + p_2u_2(s_2, Low) + p_3u_2(s_3, Low) \leq \tag{46}$$
$$u_1(W - 2\theta l_ip_i - l_ip_i) + p_1u_2(s_1) + p_2u_2(s_2, High) + p_3u_2(s_3, Low) \tag{47}$$

Solving for W, we obtain the condition that $W \leq \overline{W}_1^{PPI}$

2. When the government announces $\{T_1, h, q_2, q_3\} = \{\theta l_i p_i, \theta l_i p_i, 0, \theta l_i p_i\}$, individuals will prefer $\{L_2, L_3\} = \{High, Low\}$ to $\{Low, Low\}$ if

$$u_1(W - (1+\theta)l_i p_i) + p_1 u_2(s_1) + p_2 u_2(s_2, High) + p_3 u_2(s_3, Low) \geq \tag{48}$$
$$u_1(W - \theta l_i p_i) + p_1 u_2(s_1) + p_2 u_2(s_2, Low) + p_3 u_2(s_3, Low) \tag{49}$$

Which is equivalent to the condition that $W \geq \underline{W}_1^{PPI}$.

A.2.2 High quality margin

1. When the government announces $\{T_1, h, q_i 2, q_3\} = \{\theta l_i p_i, \theta l_i p_i, 0, \theta l_i p_i\}$, individuals will prefer $\{L_2, L_3\} = \{High, Low\}$ over $\{High, High\}$ if

$$u_1(W - (1+\theta)l_i p_i) + p_1 u_2(s_1) + p_2 u_2(s_2, High) + p_3 u_2(s_3, Low) \leq \tag{50}$$
$$u_1(W - \theta l_i p_i - 2l_i p_i) + p_1 u_2(s_1) + p_2 u_2(s_2, High) + p_3 u_2(s_3, High) \tag{51}$$

Solving for W, we obtain the condition that $W \leq \overline{W}_2^{PPI}$

2. When the government announces $\{T_1, h, q_2, q_3\} = \{2\theta l_i p_i, 0, 0, 0\}$, individuals will prefer $\{L_2, L_3\} = \{High, High\}$ to $\{High, Low\}$ if

$$u_1(W - 2l_i p_i) + p_1 u_2(s_1) + p_2 u_2(s_2, High) + p_3 u_2(s_3, High) \geq \tag{52}$$
$$u_1(W - l_i p_i) + p_1 u_2(s_1) + p_2 u_2(s_2, High) + p_3 u_2(s_3, Low) \tag{53}$$

Which is equivalent to the condition that $W \geq \underline{W}_2^{PPI}$.

A.3 Mandated Insurance

A.3.1 Low quality margin

1. If the government mandates $h^g = 2\theta l_i p_i$ individuals will choose $\{q_2, q_3\} = \{\theta l_2, \theta l_3\}$ over $\{l_2, \theta l_3\}$ whenever wealth satisfies $W < \max\{\underline{W}, W_1^{MI}\}$. See the discussion in the text.

2. On the right side of the margin, the government can induce individuals to prefer $\{q_2, q_3\} = \{l_2, \theta l_3\}$ over $\{\theta l_2, \theta l_3\}$ by mandating $h^g = (1 + \theta)l_i p_i$: such insurance level is sufficient to purchase cover $\{q_2, q_3\} = \{l_2, \theta l_3\}$, and $\{l_2, \theta l_3\}$ is preferred to $\{\theta l_2, \theta l_3\}$.

A.3.2 High quality margin

By setting $h^g = (1 + \theta)l_i p_i$ for $W \leq W_2$ and $h^g = 2l_i p_i$ for $W > W_2$ the government can induce optimal choices. To see this, note that individuals with wealth W_2 are indifferent between the two bundles.

Figure 1: Timing of events

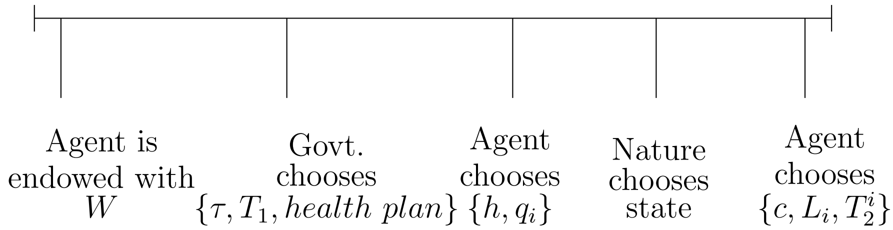
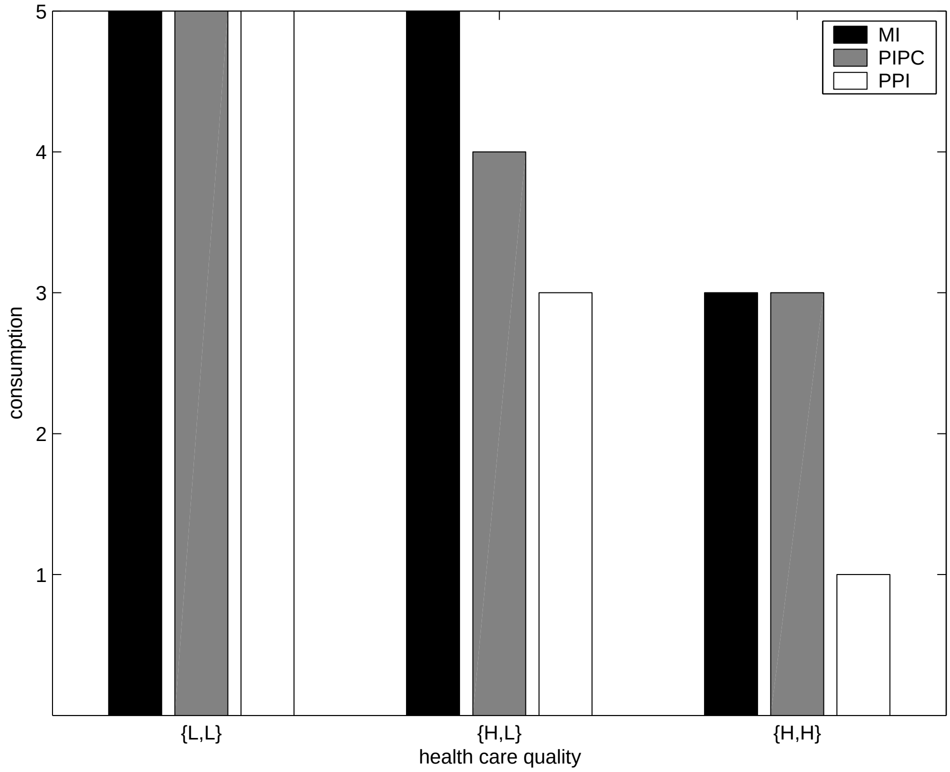


Figure 2: Consumption and health care quality under the three arrangements



Parameters :	
Net wealth $(W - h^g)$	5
Mandated/public insurance (h^g)	2
Cost of Low *quality*	1
Cost of High *quality*	2

Table 1: Distortions in health care use: Commitment (C) vs. Pure Public Insurance (PPI)

		$[W_0, W_1)$	$[W_1, \underline{W}_1^{PPI})$	$[\underline{W}_1^{PPI}, W_2)$	$[W_2, \underline{W}_2^{PPI})$	$[\underline{W}_1^{PPI}, +\infty)$
s_2	C	Low	High	High	High	High
	PPI	Low	Low	High	High	High
			-			
s_3	C	Low	Low	Low	High	High
	PPI	Low	Low	Low	Low	High
					-	

Note : (+)*indicates overconsumption/overinsurance*
(−)*indicates underconsumption/underinsurance*

Table 2: Distortions in health care use: Commitment vs. Mandated Insurance (MI)

		$[W_0, W_1^{MI})$	$[W_1^{MI}, W_1)$	$[W_1, W_2)$	$[W_2, +\infty)$
s_2	C	Low	Low	High	High
	MI	Low	High	High	High
			+		
s_3	C	Low	Low	Low	High
	MI	Low	Low	Low	High

Note : (+)*indicates overconsumption/overinsurance*
(−)*indicates underconsumption/underinsurance*