Prices *vs.* Quantities in Health Insurance Reimbursement*

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Abstract

I compare *in-kind reimbursement* (which fixes treatment quantities) and *reimbursement insurance* (which fixes treatment prices) as demand-side, cost-containment measures. In the model, illness has a negative impact on labor productivity and public insurance is financed through labor income taxation. Consumers are heterogeneous with respect to intensity of preferences for treatment which is their private information. The social planner may be constrained to adopt uniform (pooling) allocations or may be free to choose discriminating (self selecting) allocations in the reimbursement plan.

Analyzing pooling allocations I show that reimbursement insurance dominates in-kind reimbursement from a social welfare point of view. While considering self-selecting allocations I show that the two reimbursement methods are equivalent.

Keywords: public health insurance, in-kind transfers, reimbursement insurance, adverse selection.
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1 Introduction

Risk averse consumers demand health insurance. They insure against the financial risk associated with buying medical care: consumers pay a premium ex-ante and receive reimbursement if illness occurs. I will study and compare two alternative health insurance reimbursement methods: *in-kind* reimbursement and *reimbursement insurance*. Both methods are used by public and private health insurers (see Besley and Gouveia 1994), as demand-side, cost containment measures. However, as one could imagine, the two differ significantly as for welfare implications. The analysis addressed in this paper is relevant because all western economies face high budget pressure concerning health care financing and health care expenses are deeply influenced by the way insurance reimbursement affects health care consumption.

When reimbursement is in-kind (IK, henceforth), consumers directly receive the medical services they need. Access to care is free and the insurer imposes a ceiling on treatment available to consumers to prevent excessive demand for care. As a consequence, by rationing health care, *in-kind reimbursement fixes the amount of treatment* that is available to consumers. Moreover, due to free access to care with IK reimbursement, health care providers are paid directly by the insurer (see figure 1).

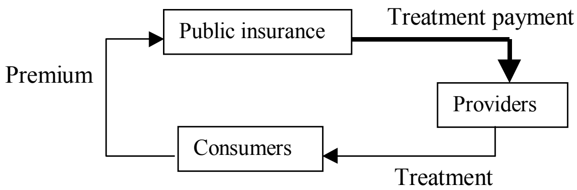

Figure 1: providers' payment with in-kind reimbursement.

On the contrary, with reimbursement insurance (RI, henceforth), consumers' payment is based on the cost of treatment, and cost-sharing between patient and the insurer reduces the cost of treatment for consumers. In particular, consumers are free to choose the quantity of treatment they desire at the consumption price that is determined by the coinsurance parameter. Thus, *with reimbursement insurance the insurer fixes the price of treatment.* Clearly, consumers do not internalize the entire health care cost, and consequently tend to demand an excessive quantity of treatment (overconsumption). This is the well known problem of ex-post moral-hazard in health insurance. Concerning physician's fees, with RI, providers are generally paid by consumers and, after the insurance claim, patients receive a partial reimbursement from the insurer (see figure 2).

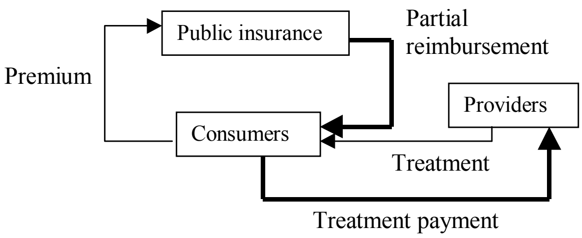

Figure 2: providers' payment with reimbursement insurance.

This simple description of the two reimbursement methods, IK and RI, obviously does not capture all their complex features. However, it provides a treatable framework which can be used to compare the two methods. The need for such comparison is also motivated by the observation that the two reimbursement methods are widely employed in the European public health insurance systems by different countries. To give an example of the relative diffusion of the two methods in Europe, in-kind reimbursement is used, for General Practitioners' and Specialists' services, in Germany, Greece, the Netherlands, Spain and the UK. Whereas, for the same services, reimbursement insurance is used in France, Belgium and Portugal.[1]

In this paper I model a public health insurance system where health care expenditure is financed by labor income taxation. This modelling strategy is comforted by the observation that direct taxation is the main source of health care financing in many EU Member States. In particular the UK, Ireland, Portugal Spain, Denmark, Sweden, Italy and Finland explicitly devolve a part of fiscal revenue to health expenses.[2] Moreover, for simplicity and in order to focus on the problem of cost containment in public health insurance provision, health care is the unique public expenditure financed by income taxation. Hence, in my model the social planner has a double role: it is both the public insurer and the fiscal authority.

Comparing IK and RI in a model of public health insurance[3], I assume that consumers are heterogeneous with respect to their preferences for treatment consumption which are not observed by the public insurer. In the first part of the work I constrain the insurance plan to be uniform in the sense that heterogeneity in propensity to treatment consumption is not taken into account. Analyzing pooling allocations I find that RI dominates IK from a social welfare point of view. This result depends on the fact that, while pooling IK constrains both ill consumers' types to the same quantity of treatment, with RI, consumers choose the preferred treatment quantity given the coinsurance parameter. Moreover,

[1]See Le Grand and Mossialos (1999).

[2]See again Le Grand and Mossialos (1999) for a general discussion of sources of finance for health care expenditure in Europe.

[3]A public health insurance was analyzed for the first time in Blonqvist and Horn (1984), in which the authors show that, if individuals differ in their earning ability and also in the probability of falling ill, then a public health insurance is an efficient tool to redistribute welfare when income taxation is linear.

with RI, treatment is subsidized such that high-type consumers are better off and the pooling allocation is more similar to first-best. In the second part of the paper, I consider self-selecting allocations, i.e. allocations where consumers can choose insurance plans which take into account their preference for treatment. In this case I show that the two reimbursement methods are equivalent. In fact, with IK, by rationing treatment the social planner is able to partially prevent patients from mimicking. In particular IK corresponds to the *direct mechanism,* which implements the optimal incentive compatible allocation, whereas RI corresponds to the *indirect mechanism* which allows the implementation of the very same allocation.

The well-known debate on prices versus quantities regulation initiated by Weitzman (1974) is clearly relevant for my paper. In fact, with IK the social planner essentially fixes treatment quantities, while with RI it sets prices. Moreover, I also borrow from the economic literature on moral-hazard in health insurance, one of the seminal papers being Zeckhauser (1970). With respect to this, the way in which I treat RI represents a particular case of the more general reimbursement schedules analyzed in his paper. As for IK reimbursement, I relate to the literature on in-kind transfers and optimal taxation (among others Cremer and Gahvari 1997) where the self-selecting property of in-kind transfers in second-best economies is studied. Finally, my paper deals with income taxation under uncertainty and it is then related to the vast literature in which taxation is used to insure consumers against various types of wage and health risks (see for example, Varian 1980 and Cremer and Gahvari 1995). However, my analysis differs from all the previous studies inasmuch it addresses an institutional comparison between two alternative reimbursement methods for health expenses, IK and RI, in a framework where the social planner has also to balance the budget. Such an analysis seems to be an unexplored issue, at least to my knowledge.

The plan of the paper is as follows. In the next section I describe the model and its assumptions. In section 3 I analyze the first-best outcomes both for IK and RI. In section 4 the different *uniform* insurance plans are first characterized and then compared. In section 5 the alternative *self-selecting* insurance plans are characterized and compared. Finally section 6 concludes.

2 The model

Consumers' earning ability is normalized to equal the wage rate and captures their health status. Illness occurs with probability p. With probability $1 - p$ consumers are healthy and their (marginal) labor productivity is w. When ill, consumers lose their earning ability and productivity falls to zero.[4]

[4]Alternatively, one could consider three possible states of health, where with an intermediate level of illness, consumers' earning ability is only partially reduced (non-serious diseases induce a smaller but non-zero productivity). Such a modellization may allow to explicitly

Consumers' preferences are state-dependent and separable. Utility is determined by aggregate consumption, labor supply and treatment consumption as follows:[5]

$$U_1(C, L) = u(C_1) - v(L) \quad (1)$$

$$U_2^j(C, X) = u(C_2) - H + \theta^j \phi(X) \quad (2)$$

where the subscript $i = 1, 2$ indicates the health status: 1 is good health, 2 corresponds to illness. C is an aggregated consumption good taken as numeraire, X is health care consumption and L is labor supply. H is a fixed utility loss which occurs in the case of illness and can be partially recovered through health care consumption. The term $\theta^j \phi(X)$ indicates the benefit from health care consumption. In particular $\phi(X)$ is health improvement from treatment consumption, while the parameter θ^j, $j = l, h$ represents intensity of preferences for treatment with $0 < \theta^l < \theta^h$. With probability μ_l consumers have low preference for health care consumption (they are low-types), while, with probability $\mu_h = 1 - \mu_l$ they have high preference for health care consumption (they are high-types). The parameter θ allows the consideration of different attitudes towards treatment. In particular, for the same illness episode, it describes heterogeneity in the propensity for treatment consumption which normally characterizes patients.[6]

Standard hypothesis on utility functions hold: $u'(C) > 0$, $u''(C) < 0$; $v'(L) > 0, v''(L) > 0, \phi'(X) > 0$ and $\phi''(X) < 0$. Moreover, $H \geq \theta^j \phi(X)$, $\forall j = l, h$ and $\forall X$, so that consumer's utility is always higher when in good health than when ill.

Aggregated consumptions C_1 corresponds to labor income wL minus the insurance premium. On the contrary, the structure of aggregated consumptions C_2 depends on the type of reimbursement which characterizes the insurance plans. In particular it depends on who pays the providers of health treatments: the social planner (in the case of in-kind reimbursement), or both the social planner and consumers (in the case of reimbursement insurance).[7] Such a point will be clarified in the next section, where IK and RI's structure will be presented with full details.

The social planner will be concerned with making comparisons of utility levels across consumers' types. Thus, full comparability of consumers' utilities is assumed.

consider both out-of-hospital and inpatient care. A previous draft of the current paper delivers this extension and is available upon request. However, the main results and intuitions remain valid also in the current simplified version.

[5] Preference's structure is similar to Blackorby and Donaldson (1988): healthy people consumption bundle is composed only by aggregate consumption, ill people also consume health care. A difference with respect to Blackorby and Donaldson is that, in the present paper, labor supply affects healthy people utility too.

[6] For example, Chernew et al. (2000) emphasize heterogeneity of preferences for health treatments as the cause of spending variation.

[7] Note that, because of the model structure, health insurance is also a *disability insurance*. In fact, in the case of illness, consumers have no resources to devote either to treatment or to aggregate consumption.

The timing of the model is as follows: at t_1 (interim) consumers learn their type and at t_2 (ex-post) the health-risk is realized and consumers learn their state of health too. As it is shown in figure 3, the social planner decides at the interim stage the insurance plan, while consumers choose either labor supply or treatment ex-post (the latter only in the case of reimbursement insurance).

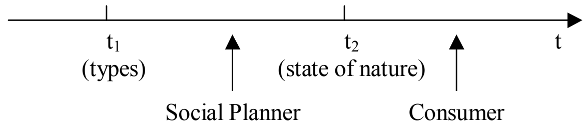

Figure 3: timing.

The health care provider is not explicitly considered in the model because I am interested in the relationship between consumers and the public insurance. The situation described here fits both the case of a public provider (vertically integrated with the public insurer) and of a private one in a competitive market. In both cases, assuming a linear technology, the health care unitary cost is constant. This allows to say that consumers and the public insurer face the same treatment price (q). Moreover, consumers choose their preferred treatment quantity, when they are reimbursed with cost-sharing (RI). This implies that the provider behaves as a perfect agent for its patients.[8]

Consumers may privately know both their marginal labor productivity w (capturing the health status) and their type θ^j (high/low propensity for treatment consumption). However, I am here interested in the study of ill consumers' allocation after insurance reimbursement is paid, as well as in the consequences of prices versus quantities regulation. Hence, I assume that θ^j is consumers' private information and the marginal labor productivity is common knowledge such that a healthy consumer cannot mimic illness by choosing $L = 0$. This simplifying assumption is here taken in order to sharpen my analysis. However, legislations in several countries allow an employer to verify that the employee is not mimicking illness by asking a physician to exert the role of public inspector for the social insurance institution (which assures a partial wage provision also in the case of illness). Moreover, the assumption of illness status observability is even more plausible when the provider is vertically integrated with the public insurer. In such a case the provider, when certifying the consumer's health status, behaves as a perfect agent for the insurance too. On the contrary, when the provider is a private agent in a competitive market, imposing the observability of the health status is equivalent to assume that collusion between patient and physician is impossible.[9]

Contrary to marginal labor productivity, preference for treatment is not

[8] An illness certification provided by a physician is here necessary to obtain insurance reimbursement.

[9] See Alger and Ma (2003) for a model of collusion between patients and physicians.

observable by the insurer (nor by the physician),[10] and the public insurance may be constrained to adopt uniform (pooling) allocations or may be free to choose discriminating (self-selecting) allocations in the reimbursement plan.

3 The structure of alternative insurance plans and the first-best

If the social planner observes ill consumers' preferences for treatment, the first best allocation can be implemented. First-best can be decentralized by a contract contingent both upon the health status and upon preference for treatment, that is a plan characterized by three non-uniform monetary transfers $(P^{FB}, R^{FBl}, R^{FBh})$.[11] Consumption in the two states of health is:

$$\begin{aligned} C_1^{FB} &= wL - P^{FB} \\ C_2^{FBl} &= R^{FBl} - qX^l \\ C_2^{FBh} &= R^{FBh} - qX^h \end{aligned}$$

where P is premium paid by healthy consumers, and R^j $(j = l, h)$ is reimbursement in the case of illness for the two consumers' types.

The social planner maximizes the utilitarian[12] social welfare function $SW = \mu_l EU(\theta^l) + \mu_h EU(\theta^h)$, where $EU(\theta^l)$ is low-type and $EU(\theta^h)$ is high-type consumers' expected utility. Expected utility of low-type and high-type consumers are respectively multiplied by the proportion of low-type and high-type consumers in the population[13]. Note that, when healthy, the two types are identical. The social planner solves:

$$\begin{cases} \underset{P^{FB},R^{FBj}}{Max} & (1-p)\left[u(wL - P^{FB}) - v(L)\right] + \\ & +p\sum_{j=l,h}\mu_j\left[u\left(R^{FBj} - qX^j\right) - H + \theta^j\phi\left(X^j\right)\right] \\ s.t.: & (1-p)\,P^{FB} = p(\mu_l R^{FBl} + \mu_h R^{FBh}) \end{cases} \tag{FB}$$

Notice that the insurance premium P is fair: the contribution of the healthy

[10] Also Chernew *et al.* (2000), in a different context, assume that individuals have *observable*, severe diseases and unobservable preferences for alternative treatments. The justification for this assumption essentially relies on vertical integration (see page 589).

[11] The first-best contract specifies all the terms of healthy and ill consumers' utility (C_1, L, C_2^j, X^j). However the choice of X^j and L can be decentralized because consumers face efficient prices w and q. Thus first-best is obtained by offering the contract $(P^{FB}, R^{FBl}, R^{FBh})$ and letting consumers choose (ex-post) either labor supply or treatment quantity.

[12] Concerning the choice of the social welfare function, the maximin principle of Rawls is 'less applicable' to cases which deals with health and the allocation of health care. For an interesting discussion on this topic see Olsen (1997).

[13] Considering a large number of consumers, μ_j is equivalent, ex-post, to the proportion of the j-type.

consumers is equivalent to the expected expenses of the ill consumes.[14]

From FOCs we find the full-insurance result:[15]

$$C_1^{FB} = C_2^{FBl} = C_2^{FBh} = C^{FB} \tag{3}$$

Moreover, it is:

$$L^{FB}(w, P^{FB}) : \quad wu'(C^{FB}) = v'(L) \tag{4}$$

$$X^{FBj}(\theta^j, R^{FBj}, q) : \quad \theta^j \phi' \left(X_2^j \right) = qu' \left(C^{FB} \right), \qquad j = l, h. \tag{5}$$

Labor supply and treatment quantity are determined such that marginal benefit equals marginal cost when aggregated consumption is optimal. In state of health 2, not surprisingly, it is $X^{FBh} > X^{FBl}$ and $R^{FBh} > R^{FBl}$: high type consumers receive a higher monetary transfer and buy a higher quantity of treatment.

In figure 4 ill consumers' first-best allocation is shown. As the reader can see, the slope of low-type utility function is higher than high-type one, in fact $\frac{dC}{dX} = -\theta^j \frac{\phi'(X^j)}{u'(C^j)}$.

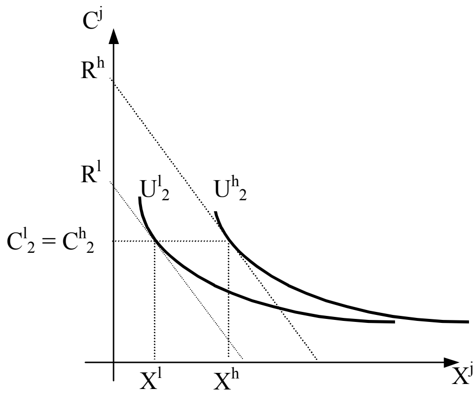

Figure 4: ill consumers' first-best allocation.

In the rest of this section I show the structure of in-kind and reimbursement insurance with full information on consumers' preferences. The two reimbursement plans will be treated in detail in the case of asymmetric information in sections 4.1 and 4.2, 5.1 and 5.2.

[14]Because of the way the parameter θ^j enters the utility functions, social welfare is increasing with respect to propensity to treatment consumption. This means that high-type consumers have the highest weight in this economy because they benefit more from health care consumption. In fact, as it is shown, the first best allocation assures the same level of aggregate consumption to both ill consumers' type and more treatment to high-type consumers. In other words the social planner redistributes from low- to high-type individuals.

[15]Even if utilities are state-dependent, in the model there is separability between aggregate consumption and treatment consumption. Then illness does not alter the marginal utility of income. As a consequence full insurance is still optimal and it obviously concerns only aggregate consumption.

In-kind reimbursement. Recall that, when reimbursement is in-kind, access to care is free (see figure 1: providers are directly paid by the social planner). As a measure against overconsumption induced by free access to health care, the social planner uses rationing and provides a ceiling to the available amount of treatment $\bar{X}$.[16] As I said before, the wage rate is observable, then the social planner will always use a monetary transfer contingent to ill-health. Moreover, with full information on preferences, such a monetary transfer and the ceiling to treatment will be contingent to ill consumers' type. As a consequence in-kind insurance plan is characterized by $(P^{IK}, R^{IKj}, \bar{X}^j)$, $j = l, h$: that is, three monetary transfers and two care packages. Health care is provided at zero cost, then patients will always entirely consume the amount $\bar{X}^j$: no intermediate levels of consumption are possible. The previous interpretation of in-kind reimbursement is quite stylized, nevertheless I believe it represents a good approximation of reality.

Consumption in the case of illness is:

$$C_2^{IKj} = R^{IKj}, \quad \text{with } X^j = \bar{X}^j$$

where $j = l, h$. Note that ill consumers' aggregate consumption is exactly equivalent to the transfer R^{IKj} and treatment consumption is the package of care $\bar{X}^j$. Obviously, with full information, this does not represent a constraint for consumers because R^{IKj} and $\bar{X}^j$ represent the amount consumers would have chosen facing efficient prices 1 and q.

Reimbursement insurance. With reimbursement insurance consumers pay a part of treatment expenses (see figure 2: treatment cost is shared between the social planner and consumers). The linear[17] cost-sharing parameter is denoted by α^j $(j = l, h)$ and the contract is characterized by $(P^{RI}, R^{RIj}, \alpha^j)$, $j = l, h$: that is, by three monetary transfers and two coinsurance parameters. Consumers choose their preferred treatment quantity at the consumption price $\alpha^j q$.

Consumption in the case of illness is:

$$C_2^{RIj} = R^{RIj} - \alpha^j q X^j$$

Remark 1 *Under perfect information, both in-kind and reimbursement insurance allow to implement the first-best allocation.*[18]

[16] See Ma (2002) for a model in which rationing is strategically used by the social planner to remedy a market failure in the private sector, when both public and private providers coexist.

[17] Reimbursement insurance is generally characterized by linear cost-sharing parameters. However, loosely speaking, insurance *could ex-post verify* treatment consumption because reimbursement is based on the provider's bill. Thus more complex, non-linear mechanisms could be implemented, although these mechanisms are practically not employed, and the analysis would be considerably more complicated. (See Blomqvist 1997 for a model with non-linear health insurance)

[18] This remark confirms Arrow (1963) when he says that, in a hypothetically perfect market, the existing different methods of treatment costs coverage should be equivalent. (Arrow 1963, page 962)

In fact, with both in-kind and reimbursement insurance, the social planner can use two additional "instruments", with respect to first-best, (respectively $\bar{X}^j$ with in-kind and α^j with reimbursement insurance, $j = l, h$) such that it can do at least as well. Obviously when monetary transfers contingent upon preference for treatment are available, these additional instruments are useless. Concerning reimbursement insurance, with full information the social planner clearly sets $\alpha^j = 1$ such that prices are not distorted.

As is evident looking at figure 4, when θ^j is not observable first-best cannot be implemented because low-type consumers would mimic high-type ones. The efficient allocation of resources is not envy-free.

Dealing with low-type incentive constraints the public insurance has a choice of two kinds of insurance plan. "Those in which the insurer is unable to distinguish (ex-post or ex-ante) among individuals: this corresponds to a pooling allocation. And those in which the high-type and the low-type can (ex-post) be identified as a result of the action undertaken by the different groups: this corresponds to a self-selecting allocation." (Stiglitz 1987, page 996)

Which kind of allocation does the social planner implement in the real world, a pooling or a self-selecting one? Does it discriminate reimbursement according to patients' tastes? Whenever consumers can have access to different qualities of treatment or different treatment options the answer is "yes". Think about the availability of single room hospitalization in National-Health-Service type organizations. Or consider the cases in which patient preferences are a determinant of treatment choices and plans allow enrollees options between treatment paths.[19] On the other side, many situations exist where the allocation is pooling, that is, where the same reimbursement is provided to all consumers with the same illness without caring about the difference in preference for treatment. In the case of uniform reimbursement the possibility of satisfying different propensity to treatment is generally left to private insurance: individuals with high preference for treatment can buy *supplementary* insurance or *opt-out* the public sector (such a behavior is not explicitly analyzed here).

Pooling and self-selecting allocations being equally plausible, in the rest of the paper I will analyze them both: pooling allocations are treated in section 4, whereas self-selecting allocations are treated in section 5.

4 Pooling allocations

With pooling allocation the same contract is offered to low- and high-type consumers. This implies that all ill consumers face the same budget constraint. Note that labor productivity observability implies that reimbursement can be contingent upon the health status, then the public insurance will always reimburse ill consumers using also a monetary transfer (but, obviously, in the

[19] In the US, managed care organizations broadly rely on shared decision-making (SDM) and disease carve-out programs to facilitate integration of patients preferences into the decision making process (see Chernew *et al.* 2000).

case of pooling allocations it will not discriminate reimbursement according to propensity to treatment consumption).

4.1 In-kind reimbursement

Under the uniformity constraint the plan is characterized by two monetary transfers and by a package of care: $(P^{IK}, R^{IK}, \bar{X})$.

Individuals' consumption in the two states of health is:

$$\begin{aligned} C_1^{IK} &= wL - P^{IK} \\ C_2^{IK} &= R^{IK}, \quad \left(X^{IKj} = \bar{X}\right) \end{aligned}$$

Note that, with respect to first-best, two constraints were added: $R^h = R^l = R^{IK}$ and $\bar{X}^l = \bar{X}^h = \bar{X}$, such that the allocation of ill consumers is completely determined.

Healthy consumers' program is:

$$\max_{L} \ u(wL - P^{IK}) - v(L)$$

Then labor supply is defined according to the following equation:

$$L^*(w, P^{IK}) : \quad wu'(C_1) = v'(L) \tag{6}$$

The public insurance program is:

$$\begin{cases} \underset{P^{IK}, R^{IK}, \bar{X}}{Max} & (1-p)\left[u(wL^* - P^{IK}) - v(L^*)\right] + \\ & +p\left[u\left(R^{IK}\right) - H + \theta_M \phi\left(\bar{X}\right)\right] \\ & \\ s.t.: & (1-p)\, P^{IK} = p\left(R^{IK} + q\bar{X}\right) \end{cases}$$

where $\theta_M = \sum\limits_{j=l,h} \mu_j \theta^j$. In fact, to implement the pooling allocation, the government maximizes the utility of the θ_M-type consumer. Not surprisingly, from FOCs with respect to P^{IK} and R^{IK} the full-insurance condition is verified:

$$C_1^{IK} = C_2^{IK} = \bar{C} \tag{7}$$

Moreover the package of treatment is determined according to the following equation:

$$\bar{X}\left(\theta_M, q, \bar{C}\right) : \qquad \theta_M \phi'\left(\bar{X}\right) = qu'(\bar{C}) \tag{8}$$

Obviously neither type of ill consumers receive the optimal quantity of treatment (determined by equation (5)). The pooling in-kind contract imposes the same allocation $\left(\bar{C}, \bar{X}\right)$ to both types of ill consumers and their utility is: $U_2^j = u(\bar{C}) - H + \theta^j \phi(\bar{X}),\ j = l, h$. Such that it is: $U_2^h - U_2^l = \phi\left(\bar{X}\right)\left(\theta^h - \theta^l\right) > 0$. This inequality shows that high-type utility is still higher than low-type utility: as in first-best, low-type consumers are characterized by a lower utility level.

It is evident that, if there is no heterogeneity $\left(\theta^l = \theta^h\right)$, we are back to first-best.

4.2 Reimbursement insurance

The uniform plan is characterized by two monetary transfers and by a coinsurance parameter: $\left(P^{RI}, R^{RI}, \alpha\right)$. Individuals' consumption in the two states of health is:

$$\begin{aligned} C_1^{RI} &= wL - P^{RI} \\ C_2^{RIj} &= R^{RI} - \alpha q X^j \end{aligned}$$

(With respect to first-best two uniformity constraints have been added: $R^h = R^l = R^{RI}$ and $\alpha^h = \alpha^l = \alpha$)

Healthy consumers' decision is the same as I showed in the previous case and equation (6) still holds with P^{RI} at the place of P^{IK}. Whereas in the case of illness consumers solve:

$$\max_{X^j} \; u\left(R^{RI} - \alpha q X^j\right) - H + \theta^j \phi\left(X^j\right)$$

As a consequence treatment quantity is chosen such that:

$$X^{*j}(\theta^j, \alpha, q, R^{RI}): \quad \theta^j \phi'\left(X^j\right) = \alpha q u'\left(C_2^j\right), \qquad j = l, h \tag{9}$$

The public insurance program is:

$$\begin{cases} \underset{P^{RI}, R^{RI}, \alpha}{Max} \quad (1-p)\left[u(wL^* - P^{RI}) - v(L^*)\right] + \\ \qquad +p \sum_{j=l,h} \mu_j \left[u\left(R^{RI} - \alpha q X^{*j}\right) - H + \theta^j \phi\left(X^{*j}\right)\right] \\ \\ s.t.: \qquad (1-p)\, P^{RI} = p\left[(1-\alpha)\, q \sum_{j=l,h} \mu_j X^{*j} + R^{RI}\right] \end{cases}$$

From FOCs with respect to P^{RI} and R^{RI} one finds the following equation:

$$E\left[u'(C_2^{RI})\right] = u'(C_1^{RI})\left[1 + (1-\alpha) q E\left[\frac{\partial X}{\partial R^{RI}}\right]\right] \tag{10}$$

where $E\left[\frac{\partial X}{\partial R^{RI}}\right] = \mu_l \frac{\partial X^l}{\partial R^{RI}} + \mu_h \frac{\partial X^h}{\partial R^{RI}}$. Totally differentiating equation (9) it results $\frac{\partial X^j}{\partial R^{RI}} > 0$, such that $E\left[\frac{\partial X}{\partial R^{RI}}\right] > 0$.

From FOC with respect to the coinsurance parameter α one finds:

$$\left[-(1-\alpha)\, E\left[\frac{\partial X}{\partial \alpha}\right] + E\left(X\right)\right] u'\left(C_1^{RI}\right) = E\left[X u'\left(C_2\right)\right] \tag{11}$$

where $E\left[\frac{\partial X}{\partial \alpha}\right] = \mu_l \frac{\partial X^l}{\partial \alpha} + \mu_h \frac{\partial X^h}{\partial \alpha}$, $E\left(X\right) = \mu_l X^l + \mu_h X^h$ and $E\left[X u'\left(C_2\right)\right] = \mu_l X^l u'\left(C_2^l\right) + \mu_h X^h u'\left(C_2^h\right)$. Totally differentiating equation (9) it results $\frac{\partial X^j}{\partial \alpha} < 0$, such that $E\left[\frac{\partial X}{\partial \alpha}\right] < 0$. Moreover, $E\left[X u'\left(C_2\right)\right] = cov\left[X, u'(C_2)\right] + E\left(X\right) E\left[u'\left(C_2\right)\right]$.

A first remark is that α is always different from 1 for positive level of heterogeneity.[20] I show later that α is always lower than 1. On the contrary, when there is no heterogeneity it is optimal to impose $\alpha = 1$, and first-best is obtained.

The interpretation of equation (11) is as follows: the left hand side represents consumers' marginal cost and the right hand side consumers' marginal benefit from a negative variation of α (a fall in treatment price). When α decreases, consumers' out-of-pocket expenses decrease as well, while insurance reimbursement expenses increase. As a consequence insurance premium must increase. Marginal cost is measured by the marginal variation of insurance premium (in brackets) multiplied for the marginal utility of consumption in the healthy state. In fact premium is paid by healthy consumers. In the right hand side the positive income effect from a negative variation of α is measured by the product of treatment quantity and consumption marginal utility in the illness status. Mean values appear because a uniform plan is implemented.

Rearranging equations (10) and (11), the optimal coinsurance parameter can be written as:[21]

$$\alpha = 1 + \frac{cov\left[X, u'(C_2)\right]}{E\left[u'(C_2)\right] E\left[\frac{\partial X}{\partial \alpha}\right] + qE\left[Xu'(C_2)\right] E\left[\frac{\partial X}{\partial R^{RI}}\right]} \tag{12}$$

Remark 2 *With uniform reimbursement insurance, treatment is always subsidized.*

Proof. Consider expression (12). $cov\left[X, u'(C_2)\right]$ is positive. It can be easily verified that $E\left[u'(C_2)\right] E\left[\frac{\partial X}{\partial \alpha}\right] + qE\left[Xu'(C_2)\right] E\left[\frac{\partial X}{\partial R^{RI}}\right]$ can be rewritten as: $\mu_h^2 u'(C_2^h)\left(\frac{\partial X^h}{\partial \alpha} + qX^h \frac{\partial X^h}{\partial R^{RI}}\right) + \mu_l^2 u'(C_2^l)\left(\frac{\partial X^l}{\partial \alpha} + qX^l \frac{\partial X^l}{\partial R^{RI}}\right) + \mu_l \mu_h u'(C_2^h)\left(\frac{\partial X^l}{\partial \alpha} + qX^h \frac{\partial X^l}{\partial R^{RI}}\right) + \mu_l \mu_h u'(C_2^l)\left(\frac{\partial X^h}{\partial \alpha} + qX^l \frac{\partial X^h}{\partial R^{RI}}\right)$. Where $\frac{\partial X^j}{\partial \alpha} + qX^j \frac{\partial X^j}{\partial R^{RI}}$, $j = l, h$, corresponds to compensated demand for treatment with respect to treatment price, which is negative. It follows that all the previous expression is negative too. Thus the denominator in the r.h.s. of (12) is negative. This implies that $\alpha < 1$. ■

The covariance with respect to X and $u'(C_2)$ reflects the objective of risk sharing: the more consumers are risk averse, the larger is the covariance and the more treatment is subsidized. At the same time, the coinsurance parameter α is negatively correlated to treatment demand mean derivatives with respect

[20] In fact, from equation (11), $\alpha = 1$ implies $u'(C_1) = \frac{E\left[Xu'(C_2)\right]}{E(X)}$; and from equation (10), $\alpha = 1$ implies $u'(C_1) = E\left[u'(C_2)\right]$. This means that it must be $E\left[u'(C_2)\right] E(X) = E\left[Xu'(C_2)\right]$, which is impossible because C_2 depends also on X.

[21] See Lipszyc and Marchand (1999) for a similar expression.

to α $\left(E\left[\frac{\partial X}{\partial \alpha}\right]\right)$. This term can be seen as a measure of moral hazard. In other words, $\frac{\partial X}{\partial \alpha}$ is related to price elasticity of demand for treatment so that equation (12) reminds us the inverse elasticity rule in Ramsey taxation: the more treatment demand is inelastic and the more treatment is subsidized.[22] Ill consumers' allocations with pooling RI is shown in figure 5.

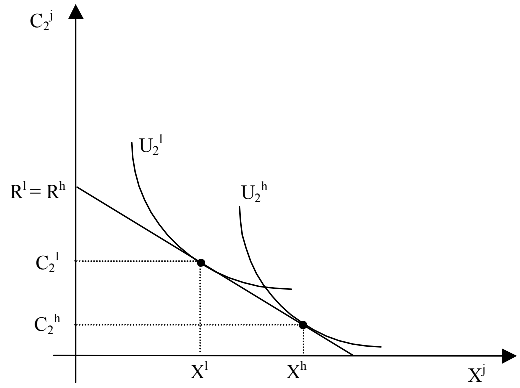

Figure 5: ill consumers' pooling allocation with reimburesement insurance.

4.3 Comparing the alternative uniform reimbursement plans

The following result holds:

Proposition 1 *When pooling allocations are implemented, reimbursement insurance dominates in-kind reimbursement.*

Proof. Recall that the two insurance plans are respectively characterized by the instruments $(P^{IK}, R^{IK}, \bar{X})$ and (P^{RI}, R^{RI}, α). The package of treatment $\bar{X}$ constraints both ill consumers' types to consume an amount of treatment which is not the preferred one (see equation (8)). With RI, on the contrary, each ill consumers' type obtains the preferred quantity of treatment, given price αq. Moreover, the *optimal* coinsurance parameter is different from one (see remark 2), this implies that distorting treatment price is welfare improving. ■

To get an intuition of this result, note that, in the presence of the uniformity constraint, the parameter α modifies treatment price such that a positive effect on social welfare is obtained (ex-post moral hazard is not a cost here). By subsidizing treatment, pooling RI makes the slope of ill consumers' budget constraint increase. Recalling that high-type consumers are characterized by a higher propensity to treatment consumption, treatment subsidization implies that high-type consumers are relatively better off and ill consumers' allocation becomes more similar to first-best.

[22] Results from the RAND Health Insurance Experiment show that health care price elasticities belong to the range [-0.1 , -0.2].

5 Self-selecting allocations

Dealing with self-selecting allocations, the previous ranking of IK and RI may be substantially affected. An important remark is that now the rationing imposed on treatment quantity by in-kind reimbursement becomes a useful instrument. Directly providing free health services, the social planner can observe treatment consumed by ill individuals. With reimbursement insurance, on the contrary, given the linear coinsurance parameter α^j, consumers choose the preferred quantity of treatment. As it was said in note 17, in the real world, the possibility to ex-post verify the quantity of treatment consumed by patients is not "exploited" by the public insurance. Thus, in practice, with RI treatment quantity is not observable and mimicking on health care consumption arises.

The social planner's programs addressed in this section are standard cases of mechanism design under adverse selection. Looking for the optimal mechanism of the two reimbursement schemes, I will then employ the well known Revelation Principle[23]. Hence, I will study direct mechanisms in which consumers (truthfully) announce their type θ and the insurer offers an allocation which specifies all the relevant variables in the contractual relationship with consumers.

Notice that for both in-kind and reimbursement insurance I shall look for the social planner's optimal allocations attainable *within each* reimbursement scheme. In particular the instruments available to the social planner will be $(P^{IK}, R^{IKj}, \bar{X}^j)$, $j = l, h$, in the case of in-kind and $(P^{RI}, R^{RIj}, \alpha^j)$, $j = l, h$, in the case of reimbursement insurance.

To have consumers truthfully report their type, the social planner has to maximize his objective function under (also) the incentive compatibility constraints. As shown at the end of section 3, low-type consumers are the mimickers. Standard mechanism design techniques with discrete types (see Fundenberg and Tirole (1991), pages 246-250) show that it is optimal to make the mimikers' incentive compatibility constraints binding thus implying that all the other constraints are satisfied.[24] As a consequence, to recover the separating allocations I will add one incentive constraint to the social planner's program: low-type ill consumers' incentive constraint.

5.1 In-kind reimbursement

As explained in section 3, access to care is free, then $\bar{X}^j$ is always entirely consumed. This implies that the social planner can observe treatment consumption, as well as ill consumers' aggregated consumption. Moreover, marginal labor productivity w is observable too, and healthy consumers' premium P^{IK} can be chosen by the social planner to induce the desired labor supply and aggregated consumption. As a consequence the contracts proposed by the social

[23] Myerson (1979), among others.

[24] A formal proof of this result is standard and then omitted. A complete proof is available from the author.

planner to healthy and ill consumers respectively are $\left(C_1^{IK}, L\right)$, $(C_2^{IKl}, \bar{X}^l)$ and $(C_2^{IKh}, \bar{X}^h)$. It is interesting to notice that in-kind represents the unconstrained direct mechanism in the sense that, given the agent's type announcement, all the relevant variables are chosen by the social planner. As a consequence we can anticipate that the in-kind optimal allocation corresponds to the allocation which weakly dominates the others.

The social planner's program then is:

$$\begin{cases} \underset{C_i^{IKj}, L^{IK}, \bar{X}^j}{Max} \quad (1-p)\left[u(C_1^{IK}) - v(L^{IK})\right] + \\ \qquad +p \sum_{j=l,h} \mu_j \left[u\left(C_2^{IKj}\right) - H + \theta^j \phi\left(\bar{X}^j\right)\right] \\ \\ s.t. : \quad (1-p)\left(wL^{IK} - C_1^{IK}\right) = p\left[\sum_{j=l,h} \mu_j C_2^{IKj} + \sum_{j=l,h} \mu_j \bar{X}^j\right] \qquad (\gamma) \\ \\ \quad u\left(C_2^{IKl}\right) + \theta^l \phi\left(\bar{X}^l\right) \geq u\left(C_2^{IKh}\right) + \theta^l \phi\left(\bar{X}^h\right) \qquad (\lambda) \end{cases}$$

where $\gamma \neq 0$ and $\lambda \geq 0$ respectively are the budget constraint Lagrange multiplier and the incentive constraint Khun Tucker multiplier.

Lemma 1 and figure 6 describe the structure of ill consumers' in-kind self-selecting allocation.

Lemma 1 *The optimal in-kind self-selecting allocation is such that contracts* $(C_2^{IKl}, \bar{X}^l)$ *and* $(C_2^{IKh}, \bar{X}^h)$ *verify* $C_2^{IKl} > C_2^{IKh}$ *and* $\bar{X}^l < \bar{X}^h$. *There is no distortion for low-type consumers while high-type consumers are forced to consume too much treatment and too little aggregate consumption.*

Proof. From FOCs with respect to C_1^{IK} and L^{IK} one finds respectively equations:

$$u'\left(C_1^{IK}\right) - \gamma = 0 \qquad (13)$$

$$v'(L^{IK}) - w\gamma = 0 \qquad (14)$$

such that, not surprisingly, labor supply still verifies: $v'(L^{IK}) = wu'\left(C_1^{IK}\right)$. Concerning ill consumers, from FOC with respect to C_2^{IKl} one finds:

$$\frac{p\mu_l + \lambda}{p\mu_l} u'\left(C_2^{IKl}\right) - \gamma = 0 \qquad (15)$$

where $\frac{p\mu_l+\lambda}{p\mu_l} \geq 1$ because $\lambda \geq 0$. Comparing with (13), $C_2^{IKl} \geq C_1^{IK}$ holds. From FOC with respect to $\bar{X}^l$ one finds:

$$\frac{p\mu_l + \lambda}{p\mu_l} \theta^l \phi'\left(\bar{X}^l\right) - q\gamma = 0 \qquad (16)$$

From (15) and (16) it follows that $\theta^l \phi' \left(\bar{X}^l\right) - qu' \left(C_2^{IKl}\right) = 0$. As a consequence low-type consumers' aggregate and treatment consumption are not distorted. From FOC with respect to C_2^{IKh} :

$$\frac{p\mu_h - \lambda}{p\mu_h} u' \left(C_2^{IKh}\right) - \gamma = 0 \tag{17}$$

where $\frac{p\mu_l - \lambda}{p\mu_l} \leq 1$. Comparing the previous equation to (13) it follows that $C_2^{IKh} \leq C_1^{IK}$. Thus $C_2^{IKh} < C_1^{IK} < C_2^{IKl}$. Recalling that the incentive constraint is binding, the previous result implies $\bar{X}^h > \bar{X}^l$, which confirms intuition. FOC with respect to $\bar{X}^h$ yields:

$$p\mu_h \theta^h \phi' \left(\bar{X}^h\right) - \lambda \theta^l \phi' \left(\bar{X}^h\right) - p\mu_h q\gamma = 0 \tag{18}$$

Solving as in Stiglitz (1987), page 1005, (17) and (18) together yield to $\theta^h \phi' \left(\bar{X}^h\right) < qu' \left(C_2^{IKh}\right)$. This proves that high-type ill consumers are forced to consume too much treatment and too little aggregate consumption. ■

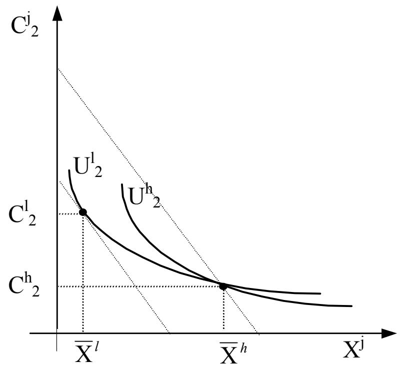

Figure 6: ill consumers' self-selecting allocation with in-kind reimbursement.

Notice that with in-kind self-selecting allocation more resources are devoted to high-type than to low-type consumers just as in the first-best allocation (see figure 4).

As I said before, in-kind reimbursement corresponds exactly to the direct mechanism in this adverse selection setting. Consumers announce their type and receive the second-best allocation. All the other relevant decisions are taken by the social planner. Interestingly, I shall show in the next section that reimbursement insurance turns out to be an indirect mechanism with which the social planner is able to implement the very same in-kind allocation.

5.2 Reimbursement insurance

With reimbursement insurance, insurance contracts are $\left(P^{RI}, L^{RI}\right)$ for healthy consumers and (R^{RIl}, α^l) and (R^{RIh}, α^h) respectively for low and high-type ill consumers. In other words the contract specifies a monetary transfer and a subsidy for treatment (a budget constraint) for each ill consumers' type.

As it is plausible to assume that treatment quantity is not observable by the social planner (see discussion at the beginnig of this section), ill consumers will choose treatment quantity according to equation (19):

$$X^{*j}\left(\theta^j, R^{RIj}, \alpha^j, q\right): \quad \theta^j \phi'(X) - \alpha^j q u'\left(R^{RIj} - \alpha^j qX\right) = 0 \tag{19}$$

while the mimickers will choose the preferred treatment quantity according to equation 20:

$$X^{*lh}\left(\theta^l, R^{RIh}, \alpha^h, q\right): \quad \theta^l \phi'(X) - \alpha^h q u'\left(R^{RIh} - \alpha^h qX\right) = 0 \tag{20}$$

The social planner's program then is:

$$\begin{cases} \underset{P^{RI},L^{RI},R^{RIj},\alpha^j}{Max} \quad (1-p)\left[u(wL^{RI} - P^{RI}) - v(L^{RI})\right] + \\ \qquad +p\sum_{j=l,h}\mu_j\left[u\left(R^{RIj} - \alpha^j qX^{*j}\right) - H + \theta^j \phi X^{*j}\right] \\ s.t.: \quad (1-p)P^{RI} = p\sum_{j=l,h}\mu_j\left(R^{RIj} + \left(1-\alpha^j\right)qX^{*j}\right) \qquad (\gamma) \\ \quad u\left(R^{RIl} - \alpha^l qX^{*l}\right) + \theta^l\phi\left(X^{*l}\right) \geq \left(R^{RIh} - \alpha^h qX^{*lh}\right) + \theta^l\phi\left(X^{*lh}\right) \qquad (\lambda) \end{cases}$$

Where $\gamma \neq 0$ and $\lambda \geq 0$ respectively are the budget constraint Lagrange multiplier and the incentive constraint Khun Tucker multiplier.

Lemma 2 describes the structure of ill consumers' self-selecting allocation with reimbursement insurance.

Lemma 2 *The optimal self-selecting allocation with reimbursement insurance is such that contracts* (R^{RIl}, α^l) *and* (R^{RIh}, α^h) *verify* $C_2^{RIl} > C_2^{RIh}$, $R^{RIl} > R^{RIh}$ *and* $\alpha^h < \alpha^l = 1$. *Low-type consumers' treatment price is not distorted, while treatment consumed by high-type consumers is subsidized.*

Proof. From FOCs with respect to P^{RI} and L^{RI} one respectively finds equations (13) and (14) where C_1^{RI} and L^{RI} must be replaced to C_1^{IK} and L^{IK}. Concerning ill consumers, from FOC with respect to R^{RIl} one finds equation (15) (with C_2^{RIl} istead of C_2^{IKl}), such that, again, $C_2^{RIl} > C_1^{RI}$. Moreover, FOC with respect to α^l yields:

$$X^l\left[p\mu_l u'\left(C_2^{RIl}\right) + \lambda u'\left(C_2^{RIl}\right) - \gamma p\mu_l\right] + \gamma p\mu_l \frac{\partial X^l}{\partial \alpha^l}\left(1-\alpha^l\right) = 0 \tag{21}$$

such that, substituting (15), $\alpha^l = 1$ holds: low-type ill consumers' treatment price is not distorted. While, from FOC with respect to R^{RIh} one finds:

$$u'\left(C_2^{RIh}\right) - \frac{\lambda}{p\mu_h}u'\left(C_2^{RIlh}\right) - \gamma = 0 \tag{22}$$

Comparing the previous equation to (13), one finds again $C_2^{RIh} < C_1^{RI}$. Finally, from FOCs with respect to α^h and R^{RIh} together it follows:

$$\alpha^h = 1 + \frac{\lambda u'\left(C_2^{RIlh}\right)\left(X^h - X^{lh}\right)}{\gamma p \mu_h \frac{\partial X^h}{\partial \alpha^h}} \tag{23}$$

where $\frac{\partial X^h}{\partial \alpha^h} < 0$, $\gamma > 0$ and, from (19) and (20), $X^h - X^{lh} > 0$. (23) shows that $\alpha^h < 1$: high-type consumer's treatment price is subsidized. Totally differentiating (19) it is easy to verify that $\frac{dR^{RIj}}{d\alpha^j} > 0$. As a consequence, according to intuition, $R^{RIl} > R^{RIh}$. ■

Ill consumers' self-selecting allocation in the case of reimbursement insurance is represented in figure 7 by the points A and B. In the figure low-type consumers are indifferent between the allocation they can reach with the budget constraint defined by $\left(R^{RIl}, \alpha^l = 1\right)$ and the allocation they can reach with the budget constraint defined by $\left(R^{RIh}, \alpha^h < 1\right)$.

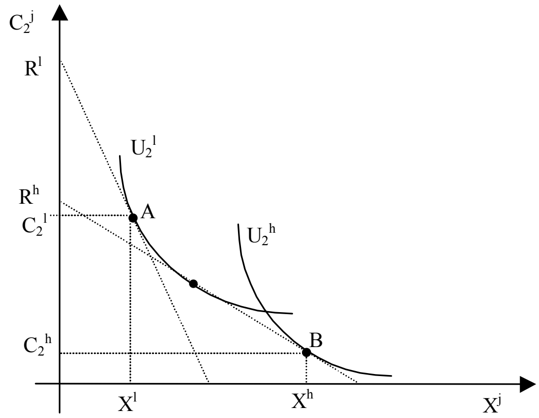

Figure 7: ill consumers' self-selecting allocation with reimbursement insurance.

Reimbursement insurance represents an indirect mechanism in this adverse selection problem. In fact consumers choose aggregate consumption and treatment after the social planner has decided the terms of the insurance contract (the budget constraint).

Remark 3 *With reimbursement insurance, the optimal in-kind self-selecting allocation cannot be implemented because it is not incentive compatible.*

Proof. Suppose the social planner offers to ill consumers the contracts $\left(R_0^{RIl}, \alpha_0^l\right)$ and $\left(R_0^{RIh}, \alpha_0^h\right)$ where $R_0^{RIl} \equiv R^{IKl} + \alpha_0^l q \bar{X}^l$, $R_0^{RIh} \equiv R^{IKh} + \alpha_0^h q \bar{X}^h$, α_0^l such that $\theta^l \phi'\left(\bar{X}^l\right) = \alpha_0^l q u'\left(R^{IKl}\right)$, α_0^h such that $\theta^h \phi'\left(\bar{X}^h\right) = \alpha_0^h q u'\left(R^{IKh}\right)$, and where the bundles $(C_2^{IKl} = R^{IKl}, \bar{X}^l)$ and $(C_2^{IKh} = R^{IKh}, \bar{X}^h)$ correspond to the optimal in-kind allocation as defined by Lemma 1. $(C_2^{IKl}, \bar{X}^l)$ and $(C_2^{IKh}, \bar{X}^h)$ are respectively represented by points 1 and 2 in figure 8 below.

From Lemma 1, we know that aggregate and treatment consumption of low-type consumers are not distorted, thus $\alpha_0^l = 1$. Moreover, $\theta^h \phi' \left(\bar{X}^h\right) < qu' \left(R^{IKh}\right)$ holds; that is, high-type consumers are forced to overconsume treatment. This implies that $\alpha_0^h < 1$. I show below that low-type consumers would not choose the in-kind allocation $(C_2^{IKl} = R^{IKl}, \bar{X}^l)$ but would prefer a bundle on high-type consumers budget constraint $\left(R_0^{RIh}, \alpha_0^h\right)$.

Low-types incentive compatibility constraint is binding, thus low-type consumers are indifferent between bundles 1 and 2. In 2, by definition, it is $\theta^h \phi' \left(\bar{X}^h\right) = \alpha_0^h qu' \left(C_2^{IKh}\right)$, as a consequence it must be:

$$\theta^l \phi' \left(\bar{X}^h\right) < \alpha_0^h qu' \left(C_2^{IKh}\right) \tag{24}$$

that is, for low-type consumers, quantity of treatment $\bar{X}^h$ is too high and aggregated consumption R^{IKh} too low, given treatment price $\alpha_0^h q$. Consider now bundle 3 where low-type consumers indifference curve is tangent to the budget constraint $\left(R_0^{RIh}, \alpha_0^h\right)$. In 3 treatment quantity X^{*lh} and aggregated consumption C_2^{*lh} are such that:

$$\theta^l \phi' \left(X^{*lh}\right) = \alpha_0^h qu' \left(C_2^{*lh}\right) \tag{25}$$

where $C_2^{*lh} = R_0^{RIh} - \alpha_0^h q X^{*lh} = R^{IKh} + \alpha_0^h q(\bar{X}^h - X^{*lh}) > C_2^{*lh}$. By comparing equations (24) and (25) it is clear that low-type consumers prefer bundle 3 to bundle 2. This implies that low-type consumers will choose bundle 3 instead of bundle 1: the in-kind self-selecting allocation is not incentive compatible. ■

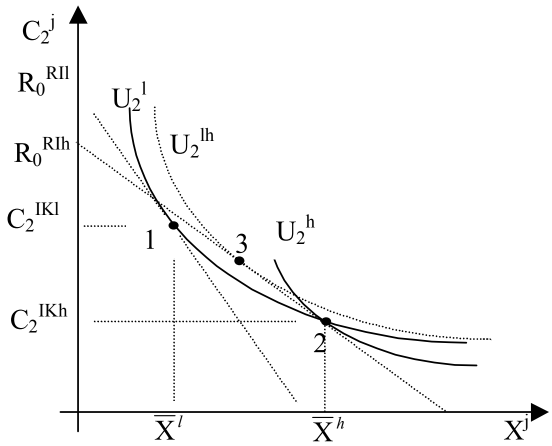

Figure 8: illustration of remark 3.

Actually the second-best allocation can be obtained with RI too. In fact, referring to the Taxation Principle in the mechanism design literature, we know that the social planner, instead of offering two linear schedules (the two budget constraints) $C_2^{RIl}(X) = R^{RIl} - \alpha^l qX$ and $C_2^{RIh}(X) = R^{RIh} - \alpha^h qX$, can offer a unique *non-linear* schedule $C_2^{RI}(X)$ which corresponds to the optimal non-linear tariff[25]. In particular this non-linear tariff allows the elimination of the "undesired" parts from the ill consumers' budget constraints such that only the points corresponding to the optimal in-kind self-selecting allocation will be chosen at the equilibrium. Figure 9 shows an example of such an optimal non-linear tariff: $C_2(X) = R^{IKl} + q\left(\bar{X}^l - X\right)$ for $X \leq \frac{R^{IKl}+q\bar{X}^l}{q}$, $C_2(X) = 0$ for $\frac{R^{IKl}+q\bar{X}^l}{q} < X < \bar{X}^h$, $C_2(X) = R^{IKh} + \alpha^h q\left(\bar{X}^h - X\right)$ for $X \geq \bar{X}^h$.

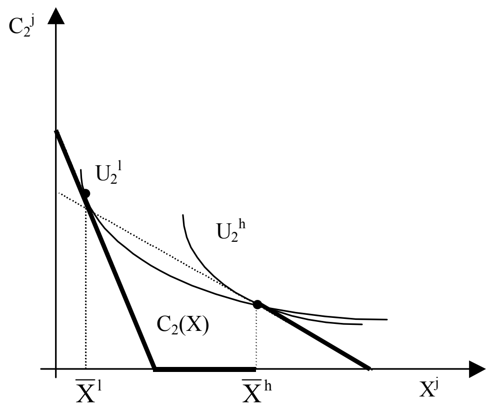

Figure 9: an example of non-linear tariff $C_2^{RI}(X)$ to implement the in-kind self-selecting allocation.

5.3 Comparing the alternative separating reimbursement plans

Sections 5.1 and 5.2 show that self-selecting allocations obtained with in-kind and reimbursement insurance are, from a social welfare point of view, equivalent. The first plan corresponds to the direct mechanism while the second corresponds to a payoff equivalent indirect mechanism. Both allow the implementation of the incentive compatible allocation. This result is stated in the following proposition.

Proposition 2 *When self-selecting allocations are implemented, in-kind reimbursement is equivalent to reimbursement insurance.*

6 Conclusion

This work presents an institutional comparison of alternative health insurance reimbursement methods: in-kind reimbursement and reimbursement insurance.

[25]Note that this schedule is the non-linear equivalent of the pooling schedule $C_2^{RI}(X) = R^{RI} - \alpha X$ which has been analyzed in section 4.2 when I treated uniform RI.

In the model health insurance is public, illness has a negative impact on labor productivity, and consumers are heterogeneous with respect to intensity of preferences for treatment. Public insurance is fully informed on consumers' labor marginal productivity but it cannot observe preference for treatment. As a consequence low-type consumers mimic high type consumers in order to receive a higher reimbursement and the public insurance may be constrained to adopt uniform (pooling) allocations or may be free to choose discriminating (self selecting) allocations in the reimbursement plan.

In the first part of the work pooling allocations are analyzed: the same reimbursement is paid to both ill consumers' types. The main result is that reimbursement insurance dominates in-kind reimbursement. The reason is that, with in-kind reimbursement, the same quantity of treatment is imposed to both ill consumers' types while, with reimbursement insurance, consumers choose the preferred quantity of treatment given the coinsurance parameter. Moreover, treatment is subsidized, such that high-type consumers are better off.

In the second part of the paper self-selecting allocations are analyzed. Intuitively, the rationale for in-kind reimbursement should be stronger in this case: by rationing treatment the public insurance should partially prevent from mimicking. The result confirms this intuition: in-kind reimbursement corresponds to the direct mechanism and then it is not dominated by any other reimbursement method. Reimbursement insurance corresponds to an indirect mechanism which is able to implement the second-best allocation too and then, from a social welfare point of view, the two are equivalent.

Finally, the structure of the model may also allow consideration of a setting with asymmetric information with respect to marginal labor productivity along the lines of the Optimal Taxation literature (Stiglitz (1987)). According to this literature, labor income is observable but earning ability and labor supply separately are not. If providers behave as perfect agents for consumers, when healthy consumers want to mimic illness, physicians certify the illness status allowing consumers to ask for reimbursement. In other words, when collusion between patients and physician is possible, healthy consumers are interested in mimicking illness in order to avoid working and to get reimbursement. I leave this study for future research.

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