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Theoretical and Empirical Perspectives on the Economics of Health Insurance: Compulsory or free Market Provision

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par

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Theoretical and Empirical Perspectives on the Economics of Health Insurance: Compulsory or free Market Provision

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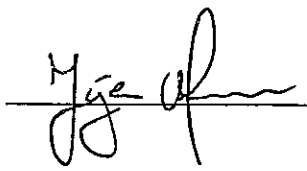
Signature :  Date : _____

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Introduction

Health is a precious good. Considerable amounts of resources are devoted to preventive and curative care. Even in developed societies, health care expenditures can be a large drain in individual disposable income. Health insurance is one possible tool to smooth health costs across individuals.

Some health problems can be very expensive to treat, but most of them are not frequent. These types of risks are among the most interesting risks to insure. For a small premium, due to their low probability of realizing, the insured will be covered against important financial consequences. In many developed societies, some form of health insurance is heavily encouraged, if not compulsory. Health insurance enhances access to care and reduces the risk of falling into poverty because of health costs, by alleviating the burden of out-of-pocket expenditures. It has also the side effect of improving the health status of the population globally. In some cases, quick treatment or preventive care, facilitated by health insurance, avoids a deterioration of the health problem.

Compulsory health insurance also permits some form of redistribution from the healthier individuals to the sick. In this sense, and because health and social status are usually correlated, health insurance can also be a tool in social policy. But health insurance can also be a purely private decision. Then, market provision is the norm. Market provision enhances efficiency, but does not take into account equity. Compulsory provision, often public, is sometimes seen as inefficient, and restricts the individuals' freedom of choice.

The advantages and drawbacks of the health insurance provision mechanisms have been, and still are, debated among the scientific community as well as among policy makers. One can observe different examples of existing systems. The two provision systems are not exclusive, they coexist in some countries.

There exists state financed health insurance systems, such as the National Health Service (NHS) in place for instance in Portugal or in the United Kingdom. Such a system allows for an important redistribution, enhancing the equity of the system. But efficiency is questionable. These systems are usually of poorer quality and often exhibit high waiting time before access to care. Social Security (Sécurité Sociale) in France is also an example

of public provision of health insurance. Its efficiency is also questioned, as its costs are tremendous. It is also often complemented by private insurance.

A ompletely deregulated system, where health insurance is mainly a private market, was partially in place in the United States, prior to the reform decided in 2010 (even though some forms of insurance existed for some categories of the population, such as the retired). Access to care was more problematic than in other countries, particularly for poorer segments of the population. Efficiency is not ensured, given that the United States have the largest health expenditures in the world (both per capita and as a proportion of GDP).

Switzerland has an intermediary system. Health insurance is decomposed in two parts. Basic health insurance is compulsory even though it is provided privately. Supplementary insurance is provided by the same insurers. The compulsory part ensures a good access to care, while the supplementary contracts enhance individual coverage on a purely voluntary basis. A mixed system is also in place in other countries, such as the Netherlands, Germany or Israel.

The Swiss way of providing a legally compulsory good through private companies has been subject to many discussions. In this work, I concentrate on three questions.

- A compulsory insurance system shares its resources among all insured. Can coexistence with market provision improve equity by concentrating on the part of the population needing public provision the most?
- The compulsory part of the Swiss health insurance system is very costly. This drains the purchasing power from the individuals and is therefore highly debated. What drives these important costs, and why are they so different across regions?
- Efficiency of market provision supposes consumers mobility across firms. This is not guaranteed in the Swiss health insurance markets. Do the insurance companies take advantage of these low switching rates through their pricing strategies?

In many countries, people who are entitled to receive health insurance for free through public insurance may opt out. In some countries there is a partial reimbursement of the health insurance premia if an individual is privately insured. In the first chapter, we are interested in analyzing the effects of subsidizing the private sector, which may have implications for efficiency and for welfare of the poor. We consider a model where poor individuals due to liquidity constraints cannot buy their optimal quality of health insurance on the private market, so they need to rely on public provision. Rich individuals freely choose whether to get insured in the private or in the public sector. We show that under some circumstances, the public provision of private good can be maximized by subsidizing the private sector. We start our analysis in a perfect information setting and we extend it to the asymmetry of information scenarios with and without competition in contracts.

Switzerland is among the countries spending a large share of their GDP on health care. In the second chapter, I look at costs reimbursed by the compulsory health insurance system. At an aggregated level, the costs are widely different across Swiss regions. The average costs per insured individual can be up to twice as important, depending on the region. As the costs are, in the end, borne by the insured themselves, this large difference has not gone unnoticed. It has been the subject of numerous discussions of political decision makers. I analyse the determinants of the health insurance expenditures across the Swiss regions over the period 2001-2007, taking into account the panel dynamics and potential endogeneity. I then consider the costs associated with the different types of care (ambulatory care, inpatient care, elderly care and drugs), in levels and as proportions of the total insurance costs in a specific fractional response model. I find that ambulatory care organisation variables are important determinant of the costs. Physicians' density has a positive impact on total costs, but negative on ambulatory costs. Hospital involvement in ambulatory care provision increases total, ambulatory costs and inpatient costs. Physicians' drugs dispensing increases ambulatory costs, but reduces drugs costs, as well as total costs. For socio-demographic variables, education has a positive impact on total costs. The low impact of a time trend suggests that health insurance costs are under control.

Health insurance provision in Switzerland is competitive. However, prices are very different for homogenous products. This puzzle can be accounted for by consumers' low switching rates. In the third chapter, we discuss the question of strategic pricing in the health insurance market. Empirically, we define low price products in several (compulsory and supplementary) health insurance markets in Switzerland. Different firms have different products priced at a low level and most firms are present in at least one market where their prices are cheaper than their competitors. This strategy seems to succeed in attracting consumers to insurance plans. As those insured are buying a low priced supplementary insurance product, in our sample, they always buy their basic insurance product from the same firm. Furthermore, once consumers have chosen a low price product, they seem to be locked in as they are less likely to move to another firm for basic insurance. We interpret this as evidence of a profitable strategic pricing behavior in the Swiss health insurance markets. Consumers don't respond optimally to price differences across firms.

Both types of health insurance provision, compulsory or free market, suffer from drawbacks. The first chapter discusses how public and private provision can coexist, and even improve on one of them alone. The subsequent chapters concentrate on the Swiss mixed provision system. The second chapter analyses how the organization of health care provision, ambulatory care in particular, together with socio-economic variables influences the compulsory health insurance costs. High costs lead directly to heavy premiums, unavoidable for the population. The third chapter explores the shortcomings of competition in the Swiss health insurance market. Health insurance companies take advantage of the low switching rates, by strategically pricing a good at a low price to attract consumers.

Contents

Chapter 1

Optimal subsidy for private health insurance providers

In collaboration with Alberto Prieto-Patron[1]

1.1 Introduction

Most governments allocate a substantial amount of resources to provide private goods or services. In cases where public and private provision are mutually exclusive, individuals have to decide whether to get the freely provided public good or buy it in the private market. Health insurance is a particular industry where we observe this interaction between private and public providers. For instance in Spain, every inhabitant has the right to get health care treatment from public facilities, nevertheless many individuals opt out to buy private insurance for private health care. The government saves money as people buy private insurance and are not using the public provision. Tax rebates to buy private insurance have been put in place to encourage individuals to opt out.

In this chapter, we discuss the advantages of giving incentives for opting out of the public sector. In our setting, health insurance is publicly and privately available. Public sector provides health insurance for free to any individual. Poor people have to rely on public provision, due to liquidity constraints. Under those circumstances the public provision of a private good is necessary to secure a minimum level of health care to the whole population.

[1]We are especially grateful to Simona Grassi for her extensive support and advice on this work. We also would like to thank Michel Mougeot for his comments on an earlier version.

Richer individuals, might be interested in opting out for (costly) private health insurance. Given that there will be a price to pay to access the private market, quality in the private sector needs to be higher to justify this increase in price.

The public budget for health care is fixed. Therefore, the resources available per patient shrink as more people are treated publicly. The government wants to provide the highest possible quality for the poor (universal provision of health care), but it cannot forbid the rich to seek public treatment. However, it can incentivize them to opt out. This increases the resources available for the poor.

How should the government allocate its fixed budget between the two alternatives? It can subsidize the private sector or it can provide health insurance. We will examine the optimal level of subsidy under perfect and asymmetric information. Under asymmetric information we analyze two possible scenarios. The first one is where private firms cannot distinguish between health risks nor can offer different contracts to induce individuals to self-select. Solidarity policy refers to this case, where a normative rule makes everyone pay the same amount of money for a health insurance plan regardless of health status. The second scenario refers to separating contracts, where although firms cannot distinguish between healthy and sick individuals, they can offer different contracts to push individuals to revel their health status.

This chapter examines the relationship between public and private providers of health insurance. This analysis could also be made on education or other publicly provided private goods.

Next section deals with literature review. In section 3, we present the model and its assumptions. We then examine different scenarios, with different information structure. Section 5 presents some examples, before we conclude.

1.2 Literature Review

This chapter builds on three different strands of literature. The first one is the literature concerning the public provision of private good. Besley and Coate (1991) set up a model where the public sector supplies a discrete private good, such as health or education. Universal provision does not mean that private provision does not exist. Depending on quality, some agents will still benefit from buying the good at a higher quality from the private sector. This permits redistribution from the rich to the poor, but is associated with some dead weight losses. Direct income redistribution via taxes is more efficient, but assumes that income is perfectly observable. Redistribution via universal public provision of a private good is possible even under some form of information asymmetry. Blömquist and Christiansen (1998) examine whether subsidizing the private sector is preferable to public providing. Both instruments lead to some distortion. In their model, the optimal

allocation between subsidy and public provision depends on the differences in consumption between the high skill (who over consume) and low skill workers. Blömquist et al. (2010) extend this analysis to cases where the quantity of good publicly provided can be individualized. This can be the case for instance in health care, when it is provided according to needs (the authors provide other examples). They showed that in these cases the taxation can be non-distortive. Hoel and Saether (2003) introduce waiting time in the public provision of health care. Patients with high waiting time costs opt out for private treatment, therefore reducing the costs of the public provision of care. Under some conditions on waiting time and welfare functions, they even recommend subsidizing private provision of care.

Henriet and Rochet (2004) address the question whether public health insurance is an appropriate instrument for redistribution. They argue that under the assumption of negative correlation of income and morbidity, theoretically a public health insurance system financed by taxes can be an efficient mean of redistribution, complementary to income taxation. Nevertheless examining data from the French public insurance system, they find out that poor individuals are using less health services in spite of being in worse health.

We borrow from this kind of models the self-selection mechanisms of the agents into private provision of the good.

The second strand of literature starts with Rotschild and Stiglitz (1976). In this paper, they show that asymmetry of information in competitive provision of insurance leads to suboptimal results. In particular, agents having an advantage over others cannot get their optimal contract. Using their example of insurance market, agents with comparatively low risk, willing to buy insurance from a competitive provider, incur a loss over their fair contract in order to signal themselves as good risks. This externality, due to the presence of high risk agents in the market, cannot be avoided under imperfect information. This paper has given rise to an important literature in economics.

In our model, we will consider the effects of asymmetry of information in competitive markets, in the presence of public provision.

Glazer and McGuire (2011) model managed competition with demand heterogeneity to create contracts in relation to efficiency and fairness in the context of the recent reform of the American health care system. They consider that heterogeneity in demand for health care is not only due to health status but also other factors which they name taste, represented by income. Efficiency is obtained through standard utility maximization. Fairness is defined as having "the sick and the healthy [paying] the same for plan membership in each plans". They advocate for regulated premiums not only for the basic plans but also on the most generous plans on the stake of efficiency.

From Glazer and McGuire's paper we borrow a part of the structure of the model but we are analyzing different health systems. They describe a health system in which every individual has to buy an insurance having two options: the high (golden) or the low

(silver) quality plan. The model is constructed in such a way that the golden plan is optimal for high income individuals whereas the silver plan is the optimal one for the poor independently of their health status. Any rich (high taste for quality) buying a silver plan or a poor (low taste for quality) buying a golden plan is inefficient. The system that we are considering is one where everybody is entitled to use the public services for free. In addition, the rich and only the rich individuals may opt out to the private sector paying the full price offering the optimal quality for them. Comparing our model with Glazer and McGuire's the golden plan would be equivalent to the one proposed to the rich in the private sector. The quality in the public sector (due to a small fixed budget constraint) is lower than in the private sector but it is not necessarily corresponding to the silver plan. First the quality in the public sector may be also suboptimal for the poor. Second, the quality in the public sector depends on how many people are treated in this sector. In our analysis when a rich individual goes to the public sector we identify two types of inefficiencies. The first one as in Glazer and McGuire is coming from a high taste individual contracting a suboptimal quality. The second comes form the fact that it has a negative externality on the rest of the users in the public sector.

The question that we examine, the balance between a subsidy to private provider and the budget available for public provision, has also been treated empirically. Emerson et al. (2001) study a tax reform in UK that caused the private health insurance plans premium for over-60 insurees to raise by a large margin. It impacted negatively the waiting lists (and therefore, the quality) in the public NHS system. Rodriguez and Stoyanova (2008) study a similar tax reform in Spain that eliminated a tax deduction for private health insurance expenditures. This reform induced the Spanish insurees to buy less individual health insurance plans, and turn to group plans. The effect on participation in private insurance plans was not significant. Still the reform alleviated the public expenditures on health care. In contrast, Lopez-Nicolàs and Vera-Hernandez (2008) use micro-simulation on the same tax reform to examine whether tax subsidies in Catalonia are self-financing, reducing the public budget for health care. They find that this tax reform was costly for the public budget.

1.3 The model

We consider three types of players: consumers, public sector and private health insurance providers. The consumers buy health insurance at a given quality. The private providers sell insurance for health care at a given quality for a fair premium. The public sector (or government) provides care (in an NHS way) at a given quality, lower than the private sector quality, for free. Quality is defined as the health expenditures per illness episode. The government can also offer a subsidy to reduce the price paid in the private sector.

1.3.1 The consumer

Consumers are characterized by their health status and their wealth levels. Consumers can be healthy or sick (denoted by i), and rich or poor (denoted by j). There are then four types of consumers (ij), healthy rich (hr), healthy poor (hp), sick rich (sr) and sick poor (sp). Health status are modeled through the number of illness episodes[2], θ_i. Sick consumers have a number of illness episodes of θ_s, and healthy consumers of θ_h, with $\theta_s > \theta_h > 0$.

For each illness episode, a single unit good of treatment is consumed. The quality of care q is defined as the health expenditures per illness episode θ_i. Therefore, the cost to insure a given level of quality to a given individual for all his illness episodes is

$$c(q) = \theta_i q \tag{1.1}$$

The valuation for quality, influenced linearly by need (i, expected number of illness episodes) and taste (j, wealth), is $v_{ij}(q) = \theta_i \phi_j(q)$. The linearity in terms of need comes from the assumption of homogeneity in illness episodes across individuals. The sick are valuing quality more than the healthy, $v_{sj}(q) > v_{hj}(q)$. The taste for quality $\phi_j(q)$ is increasing and concave in q, and independent of health status. The rich are valuing quality more than the poor, $v_{ir}(q) > v_{ip}(q)$.

If the individual is seeking insurance from the private sector, he will pay an *ex ante* premium P. Net utility U_{ij} is derived from the valuation for quality, minus the eventual premium.

$$U_{ij} = v_{ij}(q) - P \tag{1.2}$$

The first best level of quality q_j^* maximizes the valuation of quality of a given individual minus the costs of providing this level of quality to this individual.

Lemma 1 *The first best level of quality is independent of the health status.*

This comes from the assumptions that the valuation functions and the costs are both proportional to the number of illness episodes.

[2]There are no differences in illness episodes between consumers

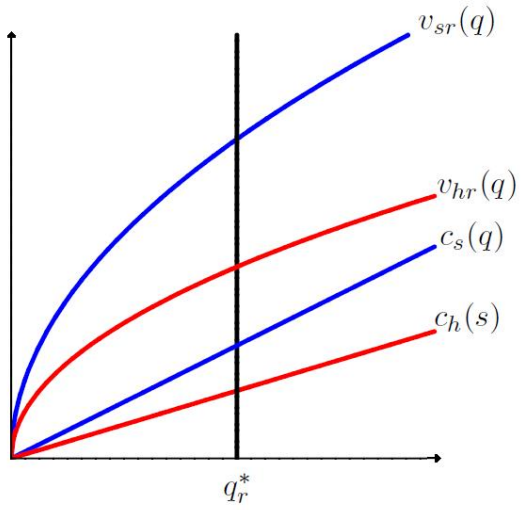


Figure 1.1: Valuation and cost for quality, and its first-best level, for healthy and sick rich

1.3.2 The public sector

The government has a fixed budget B. This budget can be used to produce health care quality and to subsidize the private sector. Public health care is offered as in an NHS insurance system. The subsidy s is a fixed amount of money per illness episode treated in the private sector, independently of the quality provided. It modifies the cost function of the private sector such that it becomes

$$c(q, s) = \theta_i(q - s) \tag{1.3}$$

We name M_{ij} the total number of consumers with health status i and wealth j. We name N the total number of illness episodes in the population. N^G is the total number of illness episodes insured by the public sector (government) and N^P the equivalent in the private sector. We also define N_{ij} as the number of illness episodes of consumers with health status i and wealth j, with then $N_{ij} = \theta_i M_{ij}$. This means that $N = N^G + N^P = \sum_{ij} N_{ij}$.

The quality in the public sector is q^G.

The budget constraint for the government is thus

$$B \geq N^G q^G - N^P s \tag{1.4}$$

For simplification, poor (low taste) individuals have to rely on public services. Due to a liquidity constraint, or because of a systematic underestimation of the risk by the poor, the state has to provide a minimum level of health care services.

Rich individuals may decide whether they prefer to benefit from the public sector offering a quality q^G, or go to the private sector and pay the market price. Public providers cannot identify who is rich and who is poor[3] but can give incentives (through the subsidy s) to the rich to go to the private sector. Having the public service free of charge ensures that all the individuals are willing to get insurance.

1.3.3 The private sector

The private provision of insurance is competitive. Firms are proposing (an insurance for) a quality of care q^P for an *ex ante* premium P, in a contract (q^P, P), in order to maximize their profits.

Lemma 2 *Under perfect competition, and no asymmetric information, private providers offer a fair premium and the first best quality for the rich.*

Lemma 2 assures that under perfect competition (therefore zero profit) and no distortions, $q^P = q_r^*$ and $P_i = \theta_i q_r^*$. Every rich consumer pays its expected costs in the private market.

1.3.4 Timing of the game

The timing of the game is as follows. The government announces a level of subsidy per illness episode treated in the private sector. Then each firm in the private sector announces the contract it proposes. The quality in the public sector and the number of rich consumers that decide to buy insurance from each sector are simultaneously solved. Rich individuals may switch from one sector to another until there is no marginal individual who would find profitable to switch.

[3]For instance because of an important underground economy, or because the public service is politically defined as universal.

1.3.5 Equilibrium under perfect risk selection and no subsidy

This section will define a simple baseline case. Under perfect risk selection, there is no information asymmetry. The private firm can discriminate contracts (q, P) between sick and healthy rich individuals (the poor have no access to the private market). Lemmas 1 and 2 explain that the quality provided by the private firms to sick and healthy rich will be the same. However, the premiums will be different. For this baseline case, we also consider that the public sector does not offer any subsidy ($s = 0$). In this case, depending on the level of the public budget B, the rich will join or not the private sector. A high public budget, and thus a public insurance for a high quality of care, induces the rich to enter the public sector.

Poor individuals have to rely on the public providers. Rich individuals maximize their utility, choosing between the public sector quality for free (q^G) and the private sector quality (q_r^*) for a fair premium ($\theta_i q_r^*$). We define $\underline{q}_{ir}^G$ as the minimum quality a rich individual may accept from the public sector providers. Formally, the minimum acceptable quality (MAQ) $\underline{q}_{ir}^G$ is defined as the quality level at which a rich individual is indifferent between the public and the private sector.

$$v_{ir}(\underline{q}_{ir}^G) = v_{ir}(q_r^*) - P_i(q_r^*) \tag{1.5}$$

Below this quality level in the public sector ($q^G < \underline{q}_{ir}^G$), a rich individual will be induced to go to the private sector. Above this quality level ($q^G > \underline{q}_{ir}^G$), the private sector cannot offer a fair contract (q_r^*, P) that attracts him, and he will get care from the public providers, together with the poor.

Lemma 3 *Under fair prices, without asymmetric information, the minimum quality the rich individuals are accepting from the public sector* $\underline{q}_{ir}^G$ *is independent from the health status,* $\underline{q}_{hr}^G = \underline{q}_{sr}^G$.

As in lemma 1, the linearity in the valuation and cost functions leads to the result.

We now consider 3 cases: very low public budget, very high public budget and an intermediary public budget.

If the public budget is very low (lower than B_1)[4] , the quality in the public sector (q^G) will be lower than the MAQ, $q^G < \underline{q}_{ir}^G$, even if the rich buy already insurance from the private sector. The rich individuals have no incentives to switch sectors. In equilibrium, all the poor individuals will get care from the public insurance at quality q^G, and all the rich individuals will buy insurance from the private sector at quality q_r^* and premium $\theta_i q_r^*$.

[4] B_1 is the public budget needed to provide $\underline{q}_{ir}^G$ to the poor population in the public sector

$$B < B_1 = \underline{q}_{ir}^G(N_{hp} + N_{sp}) \tag{1.6}$$

If the public budget is very high (higher than B_2)[5] , the quality proposed in the public sector (q^G) will higher than the MAQ, $q^G < \underline{q}^G_{ir}$, even if the rich buy already from the public sector. The rich individuals have no incentives to switch sectors. In equilibrium, all the individuals, rich and poor, will get care from the public insurance, at quality q^G.

The last case is when the public budget is in a middle range ($B_1 < B < B_2$). If all the individuals are getting care from the public insurance, the quality is too low to be accepted by the rich. They will then switch toward the private sector. However, if all the rich individuals are getting insurance from the private sector, the free quality in the public sector is appealing to them. They have then incentives to switch back toward the public sector. In equilibrium, only a fraction of the rich would buy private insurance, and the remainder will get public care, together with the poor. Utilities in both sectors have to be equivalent for the rich $v_{ir}(q^G) = v_{ir}(q^*_r) - \theta_i q^*_r$.

Proposition 1 *Under perfect risk selection and no subsidy, with public budget in a middle range ($B_1 < B < B_2$), part of the rich individuals are getting insurance in the private sector and the other part are getting insurance from the public sector. This means that $N^P < N_{hr} + N_{sr}$ and $N^G > N_{hp} + N_{sp}$. The quality in the public sector is equal to $\underline{q}^G_{ir}$.*

If a larger part of rich was getting insurance from the public sector, the quality in the public sector would deteriorate, and the private sector would become attractive for the rich. If a lower part of the rich was getting care from the public sector, the mirror situation would happen.

Figure 1.2 shows comparative statics, and the equilibrium quality in the public sector q^G, given the public budget B.

[5] B_2 is the public budget needed to provide $\underline{q}^G_{ir}$ to the whole population in the public sector

$$B > B_2 = \underline{q}^G_{ir} N \tag{1.7}$$

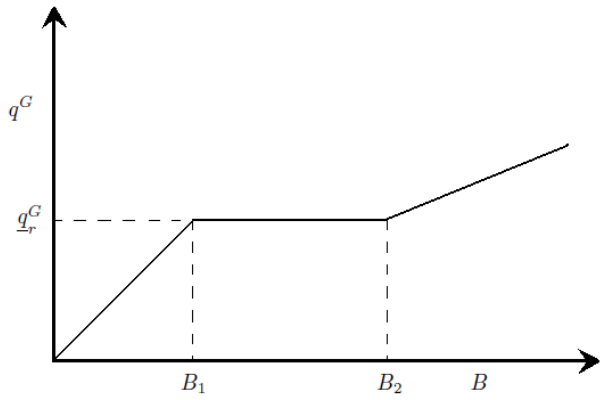


Figure 1.2: Public sector quality and budget

When the budget is low, $B < B_1$, an increase in budget is reflected in the quality of the public sector at a rate $\frac{\partial q^G}{\partial B} = \frac{1}{N_{hp}+N_{sp}}$. An increase in the budget is translated into better quality as the number of illness episodes treated remains unchanged (only the poor get treated in the public sector).

Once the public budget is greater than B_2, all individuals (rich and poor) are insured in the public sector so that, as the public budget increases, no new people enter the public sector. Therefore the quality in the public sector increases at a rate $\frac{\partial q^G}{\partial B} = \frac{1}{N}$ (the increase is shared between the total number of illness episodes in the population).

If the public budget is between B_1 and B_2, the rich individuals are attracted by the public sector as the budget increases. The quality in the public sector is temporarily above $\underline{q}_{ir}^G$, and it attracts more rich individuals. Because the quality decreases when more illness episodes are treated, this brings back the quality to $\underline{q}_{ir}^G$, where no additional rich individual is willing to enter the public sector. In equilibrium, the marginal increase of the public budget on the quality in the public sector is zero, $\frac{\partial q^G}{\partial B} = 0$.

In the remainder of the model, we will restrict the discussion to a public budget such that it cannot provide a quality beyond the first best quality for the poor, $B \leq N_p q_p^*$. We ensure that the marginal value of a quality increase in the public sector is greater for the poor than its costs.

1.4 Implementing a subsidy

1.4.1 Perfect risk selection

With a limited budget, it is still perfectly possible that the rich have incentives to get insurance from the public sector, because it is free of charge. But because the budget

is fixed, treating more people (or a greater number of illness episodes) results in a lower quality in the public sector. This is not the case in the private sector, where every individual has to pay the amount needed to treat his own illness episodes.

The most efficient outcome[6], is for the rich to get insurance in the private sector, while the poor are treated in the public sector. The rich would get their first best level of quality, while the poor would get the highest possible quality given the public budget B and their liquidity constraint.

The government, willing to maximize the level of quality offered to the poor, will offer a subsidy just sufficient for all the rich to be willing to buy the private insurance quality. This will reduce the number of people seeking insurance from the public sector, therefore improving its quality. It will also reduce the price paid in the private sector by the rich. This is Pareto improving, as long as the subsidy is less costly to the government than treating those not willing to switch in the absence of a subsidy.

Lemma 4 *Under perfect risk selection and no asymmetry of information, it is always cheaper for the public sector to subsidize the rich so that they opt out for the private sector rather than treating them directly.*

The budget constraint of the government leads the public quality to be lower than the first best quality. The definition of the first best level of quality ensures that the utility (net of costs) of q_r^* is bigger than the utility (net of costs) of the public sector quality q^G. The rich have a positive willingness to pay over the costs of public quality to get this increased utility.

With such a subsidy, each unit of treatment is reimbursed by the government an amount s. The cost function, defined by equation 1.1, is modified such that, for the private sector, the cost function is defined by equation 1.3.

The subsidy does not affect the first best level of quality of the consumers (particularly the rich). It corresponds to a lump-sum transfer per illness episode. It therefore has no distortive effects[7]. However, because of perfect competition, it will reduce the premium P_i paid to buy the first best level of quality q_r^* in the private sector. With a subsidy s, this premium becomes

$$P_i = \theta_i(q_r^* - s) \tag{1.8}$$

[6]Maximizing a utilitarian social welfare function of the total surplus from health insurance over costs, whether it is publicly or privately financed

$$max \sum_{ij} (v(q_{ij}) - c(q_{ij}))$$

[7]The first best level of quality without a subsidy is defined as $q_j^* = argmax_q(v_{ij}(q) - \theta_i q)$. With a subsidy, it becomes $q_j^* = argmax_q(v_{ij}(q) - \theta_i(q - s))$. The derivatives of these functions with respect to q are equal.

Note that, as we consider perfect risk selection, the premium paid by healthy and sick rich are different, even though the quality level is the same.

As previously, the equilibrium is attained when the rich individuals are indifferent between getting insurance from the public and from the private sector, taking now into account the subsidy s. Substituting the fair price with a subsidy, defined in equation 1.8, into the indifference condition 1.5, we get

$$v_{ir}(\underline{q}_{ir}^G) = v_{ir}(q_r^*) - \theta_i(q_r^* - s) \tag{1.9}$$

Equation 1.9 implicitly defines the function $\underline{q}_{ir}^G(s)$, which relates the MAQ with the subsidy level. Note that lemma 3 still applies, the MAQ are independent from the health status.

Lemma 5 *The minimum acceptable quality in the public sector $\underline{q}_{ir}^G(s)$ increases with s at an increasing rate, $\frac{\partial \underline{q}_{ir}^G(s)}{\partial s} > 0$, and $\frac{\partial \underline{q}_{ir}^G(s)^2}{\partial^2 s} > 0$.*

The bigger the subsidy, the less costly it is for the rich to get insurance in the private sector, so the quality they are ready to accept from the public sector needs to be higher.

With a subsidy respecting the indifference condition 1.9, the rich individuals are buying insurance from the private sector and the poor are receiving it from the public sector. This means that $N^G = N_{hp} + N_{sp}$ and $N^P = N_{hr} + N_{sr}$. The budget constraint of the government, equation 1.4, can be rewritten

$$q_p^G = \frac{B - s(N_{hr} + N_{sr})}{N_{hp} + N_{sp}} \tag{1.10}$$

This defines $q_p^G(s)$, a budget constraint that would represent the quality in the public sector, available to the poor, as a function of the subsidy s, when all rich individuals are in the private sector. The quality affordable in the public sector $q_p^G(s)$ decreases linearly with the subsidy s.

In figure 1.3, we plot the two functions relating the subsidy level s to the quality in the public sector q^G. The first one is the minimum acceptable quality (MAQ) for the rich, as a function of the subsidy $\underline{q}_{ir}^G(s)$. Quality needs to be below this level for the rich to be willing to buy private insurance. The second one is the budget constraint of the government, given the subsidy, $q_p^G(s)$. Quality also needs to be below this line to respect it. Let us recall that the government objective function is to maximize the quality available to the poor in the public sector, q^G.

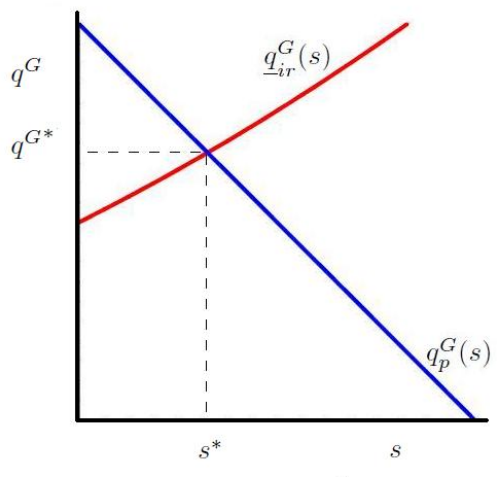


Figure 1.3: Public sector quality and subsidy

The optimal level of subsidy, s^*, is such that functions $\underline{q}^G_{ir}(s)$ and $q^G_p(s)$ cross. At this subsidy level, the quality is maximized for the poor in the public sector, and the rich are indifferent between the quality in the public sector and the private market quality.

Proposition 2 *Under perfect risk selection, a subsidy s^*, defined as $\underline{q}^G_{ir}(s^*) = q^G_p(s^*)$, maximizes the objective function of the government. For $s^* > 0$, it is also an improvement in a Pareto sense over the no subsidy case.*

At $\underline{q}^G_{ir}(s^*) = q^G_p(s^*)$, the quality in the public sector is maximized, as the rich are opting out, and they are cheaper to subsidize than to treat. The poor are therefore better off. A positive subsidy can only increase the welfare of the rich.

The poor are getting a higher quality, because the rich are out of the public sector. The rich are not willing to participate in the public sector, even though the quality increases as a result of the subsidy policy. By construction, they are indifferent between the public and the private sector provision.

Note that it would be perfectly possible to observe a case where $s^* < 0$, the subsidy being in effect a tax. This would mean that the public budget is low enough, such that the budget constraint $q^G_p(s)$ defined in equation 1.3 crosses the minimum acceptable quality for the rich $\underline{q}^G_r(s)$ defined in equation 1.9 at a point where $s < 0$.

1.4.2 Solidarity between sick and healthy individuals in the private sector

In the previous section, the healthy and sick rich were paying different premium for the same quality level. Regarding health care, a normative rule that is widely accepted is solidarity among sick and healthy patients. The government might be willing to impose solidarity in the private sector, between healthy and sick rich. Discrimination based on health status is not possible, either because of asymmetry of information or because regulation prevents it. Additionally, the government will forbid competition in contracts (q, P), allowing only competition in prices. In such cases, the risks are pooled in the private sector. The premium is the same for every consumer seeking private insurance. Because of perfect competition, the firms will then rely on average cost pricing. Another explanation would be the existence of a (perfect) risk adjustment mechanism. Such a mechanism will smooth the costs among the risk types in the private sector, and also lead to average cost pricing.

We impose in this section that the private firms cannot offer different contracts to the healthy and sick individuals[8]. The quality level is q_r^*. The fair premium for any level of quality is therefore the average cost for all the individuals buying the private product. The subsidy provided by the government can induce the rich and healthy individuals (the pivotal consumers) to join the private sector (effectively subsidizing the sick), increasing the utility in both the public sector and private sector.

Average cost pricing implies that the premium paid by healthy and sick rich opting out is the same. But its level depends on the participation of the healthy rich in the private market. If all rich (healthy and sick) individuals are participating in the private sector, the price would be equal to the average cost, $P_h(q_r^*) = P_s(q_r^*) = \frac{N_{rs}+N_{rh}}{M_{rs}+M_{rh}}(q_r^* - s)$. If only the sick rich buy private insurance, the equilibrium price becomes $P_{s,q_r^*} = \theta_s(q_r^* - s)$. Because the sick rich have a higher valuation for quality than the healthy rich , they are the first ones to join the private sector. Their willingness to pay for quality is higher. At some levels of prices, the rich and healthy are still better off in the public sector.

We will now have two indifference conditions for the healthy and rich out of equation 1.5, one where all the rich (healthy and sick) are treated in the private sector, and one where only the sick rich buy the private insurance. The MAQ for the sick rich, when the healthy rich are not participating in the private sector, is $\underline{q}_{sr}^G(s)$, defined through equation 1.9. When the healthy rich are participating in the private sector, the sick rick are subsidized, and therefore anyway willing to participate in the private sector. The healthy rich face different prices in the private sector, depending on whether they are already opting out, or whether they are publicly treated. Their MAQ are different.

$$v_{hr}(\underline{q}_{hr}^G) = v_{hr}(q_r^*) - \frac{N_{sr}+N_{hr}}{M_{sr}+M_{hr}}(q_r^* - s) \tag{1.11}$$

$$v_{hr}(\underline{q}_{hr}^G) = v_{hr}(q_r^*) - \theta_s(q_r^* - s) \tag{1.12}$$

[8]Note that we also assume that private providers cannot specialize into insuring only the sick or only the healthy.

We name $\underline{q}_{hr}^{G[1]}(s)$ and $\underline{q}_{hr}^{G[2]}(s)$ the implicit functions defined by equations 1.11 and 1.12 respectively. Those equations relate the MAQ for healthy rich individuals to be indifferent with the private sector at a fair market price, with them being in the private sector ($\underline{q}_{hr}^{G[1]}(s)$, equation 1.11) or not ($\underline{q}_{hr}^{G[2]}(s)$, equation 1.12). The solidarity policy represents an increase in the premium for healthy rich individuals with respect to the perfect risk selection case. It induces the functions $\underline{q}_{hr}^{G[1]}(s)$ and $\underline{q}_{hr}^{G[2]}(s)$ to be shifted to the right of the $\underline{q}_{sr}^{G}(s)$ function[9].

Lemma 6 *Under a solidarity policy, the minimum acceptable qualities* $\underline{q}_{hr}^{G[1]}(s)$ *and* $\underline{q}_{hr}^{G[2]}(s)$ *in the public sector for the healthy rich are increasing and convex in* s*. At any subsidy level* s*, we have that* $\underline{q}_{sr}^{G}(s) > \underline{q}_{hr}^{G[1]}(s) > \underline{q}_{hr}^{G[2]}(s)$*.*

The bigger the subsidy, the less costly it is for the rich to get insurance in the private sector, so the quality they are ready to accept from the public sector needs to be higher, irrespective of their health status. Because of the health risks ordering, it is easier to convince the sick to opt out than the rich. At the same time, it is easier to convince a healthy to opt out when other healthy already opted out, improving the risk pool in the private sector. The healthy rich have to decide between subsidizing the sick rich and giving up on the additional quality available in the private sector.

We also define the government budget constraint when healthy rich are not participating in the private market, $q_{hr}^{G}(s)$.

$$q_{hr}^{G}(s) = \frac{B - sN_{sr}}{N_{hp} + N_{sp} + N_{hr}} \tag{1.13}$$

The quality affordable in the public sector when the healthy rich are also treated by public providers, $q_{hr}^{G}(s)$, decreases with the subsidy s. If all the rich (healthy and sick) are opting out, the budget constraint of the government is q_{p}^{G}, defined by equation 1.10.

In figure 1.4, we plot the MAQ for the sick rich $\underline{q}_{sr}^{G}$, for the healthy rich when only sick rich are in the private sector $\underline{q}_{hr}^{G[1]}(s)$ and for the healthy rich when all the rich opt out $\underline{q}_{hr}^{G[2]}(s)$. We also plot the government budget constraint when the rich are all participating in the private sector $q_{p}^{G}(s)$ and when only the sick rich are buying private insurance $q_{hr}^{G}(s)$.

[9]Note that, because of Lemma 3, $\underline{q}_{sr}^{G}(s) = \underline{q}_{ir}^{G}(s)$, as seen in the discrimination case.

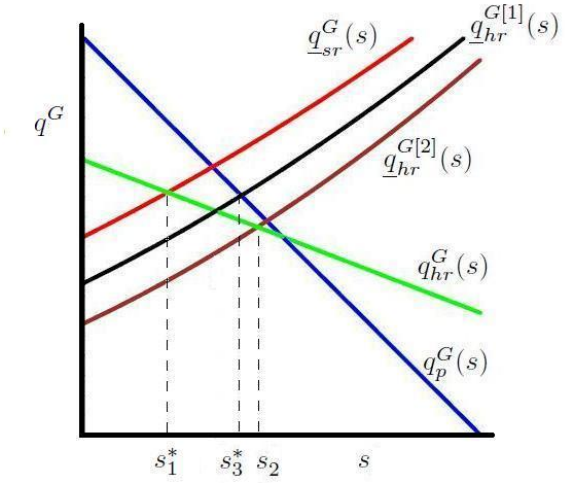


Figure 1.4: Public sector quality and subsidy under health solidarity policy

At a subsidy level s_1^*, the sick rich individuals are willing to leave the public sector. Because only the sick individuals are in the private sector, the price is high and the healthy rich do not want to join the private sector. In order to induce the healthy rich to join the private sector, the level of the subsidy has to reach s_2. At this subsidy level, all the rich (healthy and sick) are willing to join the private sector. Once the healthy rich switch from the public to the private sector the average risk in the private sector improves, which leads to a decrease in the average cost and therefore a decrease in the premium. Thus there is even more incentives to participate in the private sector. As the risk in the private sector lowers, the minimum acceptable quality in the public sector for the healthy rich individuals changes from function $\underline{q}^{[2]}_{hr}(s_2)$ (high average cost) to $\underline{q}^{[1]}_{hr}(s_2)$ (low average cost). Consequently, quality in the public sector jumps from $q^{G[2]}_{hr}(s_2)$ to $q^{G[1]}_{hr}(s_2)$. In order to sustain this equilibrium, the necessary level of subsidy is reduced to s_3^*. A subsidy level s_3^* is not sufficient to induce the healthy rich to move to the private sector when the average cost is high (only the sick rich are in the private sector). However, it is sufficient to induce them to stay in the private sector when the average cost is low (all the rich are in the private sector).

There are two equilibriums, s_1^* where the sick rich are in the private sector, all the other consumers are in the public sector, and s_3^* where the (healthy and sick) rich are in the private sectors and the poor in the public sector. It is not clear which of the two equilibriums would lead to a higher quality in the public sector (and therefore for the poor). The advantage of the equilibrium s_3^* is that it reaches the first best quality level q_r^* for all rich individuals, and at the same time the solidarity policy is effective (the healthy subsidize the sick in the private sector). If $\underline{q}^{G[1]}_{hr}(s_3^*) > \underline{q}^{G}_{hr}(s_1^*)$, then s_3^* clearly would be Pareto superior to s_1^*. In this case, the quality the public sector can offer is higher when all the rich are in the private sector. On the contrary, if $\underline{q}^{G}_{hr}(s_1^*) > \underline{q}^{G[1]}_{hr}(s_3^*)$, neither of the

two equilibrium would Pareto dominate the other, and there would be a trade off between effectively implementing solidarity in the private sector (decreasing the premium for the sick rich) and the welfare of the poor (offering a higher quality in the public sector under s_1^* than under s_3^*).

Proposition 3 *There are two potential equilibrium, at s_1^*, where the healthy rich are in the public sector, and s_3^*, where all the rich are opting out. If and only if $\underline{q}_r^{G[1]}(s_3^*) \geq \underline{q}_{sr}^{G}(s_1^*)$, then s_3^* is Pareto dominating s_1^*.*

Because of risk pooling in the private sector, the healthy rich are facing a trade off. Either they accept to subsidize the sick rich, or they give up on the additional quality that the private sector can offer. Therefore, it is more costly to subsidize the healthy than the sick. It might be more costly to subsidize them than to treat them. If it is cheap enough to subsidize them, the poor are better off, and the sick rich are benefiting from an improved risk pool.

1.4.3 Risk selection with asymmetry of information

In a system where 2 risks types coexist, but the risk type is a private information, a separating contract is 2nd best efficient and achievable.

In this type of setting, the low-risk type do not get their first best contract. They however incur a loss to signal their type in an incentive-compatible way. As under the previous solidarity policy, the healthy rich face the trade off of not getting the higher private quality, or giving up part of this quality to signal themselves as good risks. We turn to such a framework.

In the public sector, again only one contract is offered. In the private sector, however, two different contracts are proposed to the rich. They are incentive-compatible in the sense that sick rich are not willing to buy the contract proposed to the healthy rich . The sick rich get their first best contract q_r^* at a price $P_{sr} = \theta_s(q_r^* - s)$. The healthy rich[10] are getting a rebate to buy a lower quality q_{hr} at a price $P_{hr} = \theta_h(q_{hr} - s)$. The incentive compatibility constraint (ICC) is as follows:

$$v_{sr}(q_{hr}) - P(q_h r) \leq v_{sr}(q_r^*) - P(q_r^*) \tag{1.14}$$

ICC 1.14 postulates that sick rich people would not benefit if they mimic the behavior of the healthy. No other ICC is needed, as healthy individuals would have no interest in reporting that they are sick and paying the premium designed for the sick. However,

[10]The healthy rich could not get their first best contract. If it were the case, it would be cheaper for the sick rich to buy this contract than the one designed for them.

equation 1.14 will be binding, and can be rewritten in the form of an equality, imposing fair premiums.

$$v_{sr}(q_{hr}) - \theta_h(q_{hr} - s) - v_{sr}(q^*) + \theta_s(q_r^* - s) = 0 \tag{1.15}$$

Equation 1.15 implicitly defines a maximum quality $\overline{q}_{hr}(s)$ that can be offered to the healthy rich, as a function of the subsidy s. Any fair contract where $q_{hr} > \overline{q}_{hr}(s)$ would also attract the sick rich. Quality level $\overline{q}_{hr}(s)$ is as close as possible to the first best, while remaining incentive compatible.

Lemma 7 *Under risk selection with asymmetric information, the sick rich are getting their first-best level of quality, q_r^* at a fair premium $P(q_{sr}) = \theta_s(q_r^* - s)$. The healthy rich are getting quality $\overline{q}_{hr}(s)$ at a fair premium $P(q_{hr}) = \theta_h(\overline{q}_{hr}(s) - s)$. The decrease in quality incurred by the healthy rich to signal themselves as good risks is reduced by the subsidy.*

Because of incentive compatibility constraints, the healthy rich have to pay a price to signal themselves as good risks. They are therefore not getting the first best quality, while the sick rich don't have this problem. Because of the subsidy, the premium is reduced for the sick. They are therefore less tempted by a lower quality at a lower price. This lower quality that the healthy are getting can be higher.

For the rich to be willing to enter the private market, the contract for the healthy rich has also to satisfy their MAQ.

$$v_{hr}(q^G) = v_{hr}(\overline{q}_{hr}) - P_{hr} \tag{1.16}$$

Equation 1.16 implicitly defines the function $\underline{q}_{hr}^G(s)$, which relates the minimum acceptable quality level in the public sector for the healthy rich with the subsidy level s. The minimum acceptable quality for the sick rich, $\underline{q}_{sr}^G(s)$, is again defined through equation 1.9. Note that, if the quality in the public sector is such that the healthy rich are willing to enter the private market, the sick rich, that get their first best contract, are anyway willing to enter the private market, $\underline{q}_{sr}^G(s) > \underline{q}_{hr}^G(s)$.

Lemma 8 *Under risk selection with asymmetric information, the minimum acceptable quality in the public sector for the healthy rich is increasing with s at an increasing rate, $\frac{\partial \underline{q}_{hr}^G(s)}{\partial s} > 0$. Healthy rich are pivotal, $\underline{q}_{sr}^G(s) > \underline{q}_{hr}^G(s)$.*

The bigger the subsidy, the less costly it is for the rich to get insurance in the private sector, so the quality they are ready to accept from the public sector needs to be higher. Healthy rich are not getting their first best quality, but still paying fair premiums. Their utility in the private sector is lower than the utility of the sick, and they are therefore more easily interested by the public sector quality.

As in the solidarity setting presented earlier, the budget constraint when only the sick rich are treated in the private sector $q^G_{hr}(s)$ is defined in equation 1.13. The budget constraint where all the rich are treated in the private sector $q^G_p(s)$ is defined in equation 1.10.

In figure 1.5, we plot the MAQ for the sick rich participating alone in the private sector $\underline{q}^G_{sr}$ and the MAQ for the healthy rich also participating $\underline{q}^G_{hr}(s)$.

The government budget constraints when the rich are all participating in the private sector $q^G_p(s)$ and when the healthy rich are instead participating in the public sector, but the sick rich are still participating in the private sector, $q^G_{hr}(s)$ are also represented.

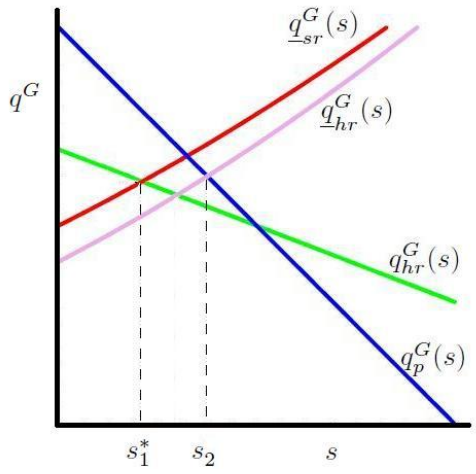


Figure 1.5: Public sector quality and subsidy under separating contracts

Again two equilibriums are possible. The first equilibrium is when only the sick rich are buying private quality care through insurance, at a subsidy level s^*_1. At this subsidy level, the healthy rich are not willing to enter the private sector, because the quality in the public sector is above their minimum acceptable quality $\underline{q}_{hr}(s)$. The equilibrium is sustainable, as the budget constraint $q^G_{hr}(s)$ assumes a subsidy only for the sick rich, and treatment for the healthy rich. The second equilibrium, at subsidy level s^*_2, takes place when all the rich are participating in the private sector. The MAQ that matters is the one of the healthy rich $\underline{q}^G_{hr}(s)$. Subsidy level s^*_2 is also feasible, lying on the budget constraint $q^G_p(s)$. It is not clear which of the two equilibriums would lead to a higher quality in the public sector (and therefore for the poor).

Proposition 4 *There are two potential equilibrium, at s_1^*, where the healthy rich are in the public sector, and s_2^*, where all the rich are opting out. If and only if $\underline{q}_{hr}^G(s_2^*) \geq \underline{q}_{sr}^G(s_1^*)$, then s_2^*, where the healthy rich are participating in the private market, is Pareto dominating s_1^*, where the healthy rich are receiving public insurance.*

Again, the healthy rich face a trade off between signaling themselves as good risks or giving up on the additional private sector quality. Because of it, it is more costly to subsidize the healthy than the sick. It might be more costly to subsidize them than to treat them. If it is cheap enough to subsidize them, the poor are better off.

1.5 Model example

To illustrate our insights we introduce the following example where the value function for quality takes the form $v_{ir}(q) = \theta_i k q^{\frac{1}{a}}$. The parameter $a > 1$ is an indicator of the concavity (inverse elasticity) of the utility function with respect to the quality of health care[11]. $k > 0$, is a scaling factor for the utility function with respect to the marginal utility of quality. Based on this example, we want to illustrate some predictions for different budget sizes, proportions of the population of sick and healthy, rich and poor and difference in the number of illness episodes between the healthy and sick individuals.

We set specific values for the parameters in the reference case of our example, $a = 2$, $k = 8$, $\theta_h = 4$, $\theta_s = 5$, $M_{sp} = M_{sr} = M_{hp} = M_{hr} = 25$. Finally, the budget is such that the quality in the public sector, if all individuals are receiving public insurance, is 1/4 of the optimal quality q_r^*, $B = \frac{0.25 q_r^*}{\theta_s M_{sp} + \theta_s M_{sr} + \theta_h M_{hp} + \theta_h M_{hr}}$. This imposes that the quality of the public sector, when treating all the agents in the population, is standardized for all variations of the model that we will introduce. This set of parameters leads to $q_r^* = 16$, $q^G = 4$ if everybody (rich and poor) is in the public sector. All the potential equilibrium, and the values of q^G and s associated with them, are listed in the appendix. For example, under perfect information, with the set of parameters listed above, $q^G(s^*) = 5.40$ and $s^* = 2.60$.

With those values, we do not pretend to calibrate the model in comparison with the reality; we rather sketch what may be the possible scenarios with different relative size of the parameters.

In the subsequent sections, we are going to analyze the effect of changing one of the parameters (B, M_{ij}, θ_i) on the potential equilibrium under perfect information, solidarity policy and separating contracts.

[11] We need that $a > \frac{\theta_s}{\theta_h}$, while not being "'too big"'. If this is not the case, we end up with weird solutions, implying negative utilities, or negative private sector quality.

1.5.1 Budget change

In figure 1.6, we compare the reference case with a budget that is reduced to 20% of the baseline budget. The result is that no positive subsidy s could improve the quality in the public sector, for none of the three cases analyzed: perfect information, solidarity policy and separating contracts. In fact, if a tax on the private providers is possible ($s < 0$), it would increase the quality in the public sector.

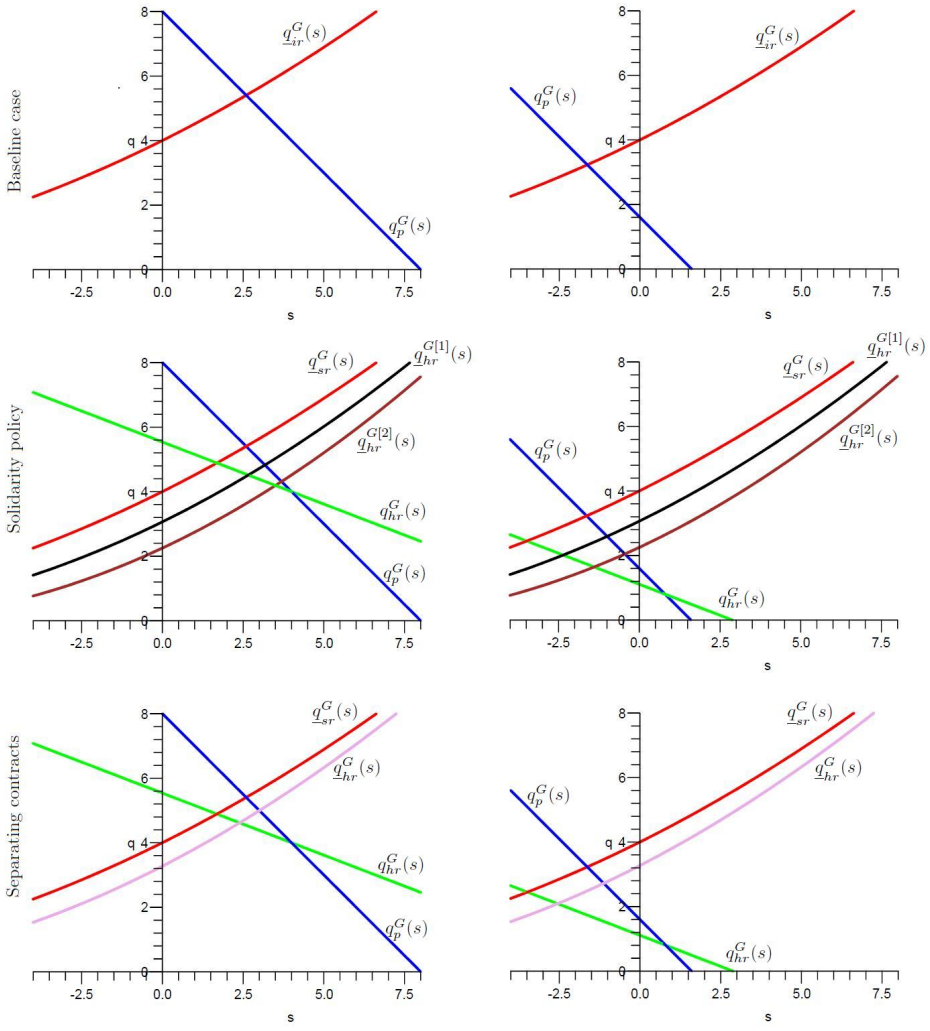
In the perfect information scenario, reducing the public budget to 20% of its original value leads to a quality reduction in the public sector of less than a half, from 5.40 to 3.22. The slower decline in the public sector quality is explained by a change in the optimal subsidy from 2.60 to - 1.63 monetary units.

With a higher budget, the subsidy is less costly than treating people in the public sector. With a high budget the quality in the public sector is 4 if rich and poor are treated in the public sector. Having a subsidy of 2.60 monetary units induces the rich to opt out to the private sector. The quality in the public sector becomes 5.40. The subsidy is less than half of what rich would cost if they were treated in the public sector.

In the solidarity policy and separating contracts scenarios, we also observe that the quality reduction in the public sector is lower than the reduction in the budget. The budget constraints $q_p^G(s)$ and $q_{hr}^G(s)$ keep the same slopes but they are shifted to the left. The MAQ functions are independent of the budget size.

Figure 1.6: Example different size in budget

High budget Low budget



1.5.2 Different proportions of rich and poor

We revert to the original set of parameters. Changing the proportion in the number of rich and poor is reflected in a change of the slopes of the budget constraints $q_p^G(s)$ and $q_{hr}^G(s)$. The bigger the share of rich people, the steeper the slopes of the budget constraints, therefore the potential benefit of increasing quality in the public sector through a subsidy policy is higher when the proportion of poor is low.

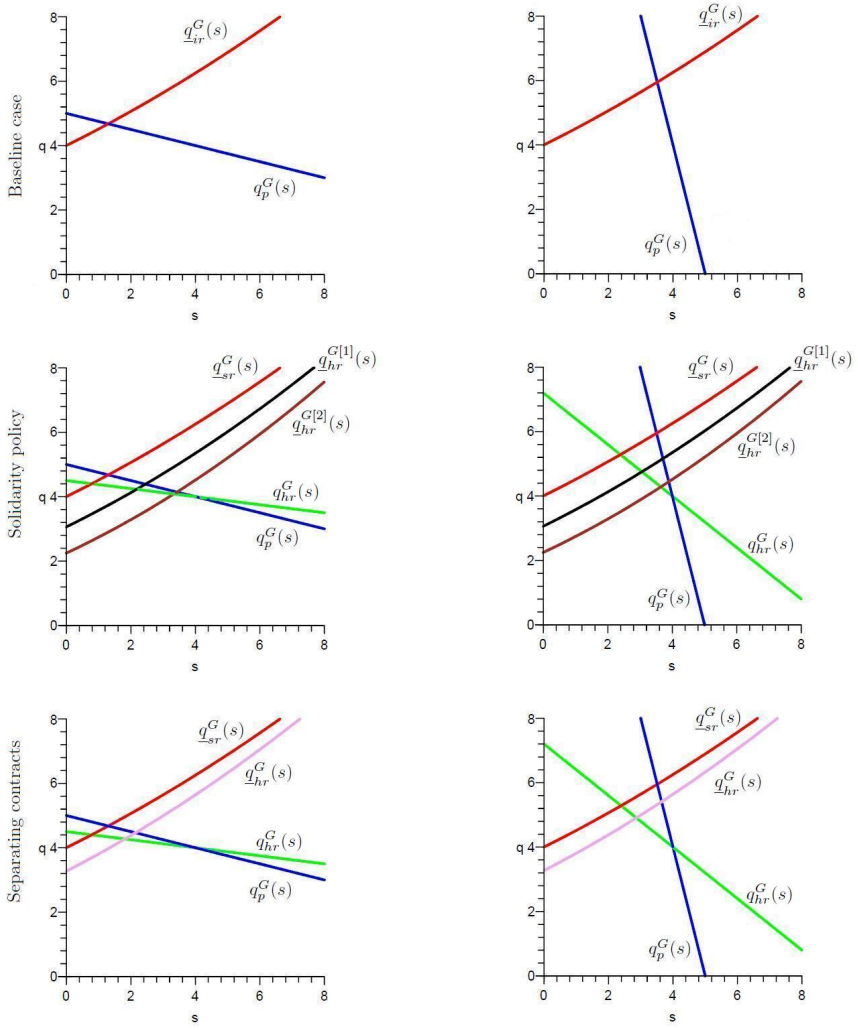
In figure 1.7, we change the share of poor and rich. On the left hand side, the poor represent 80% of the population. On the right hand side, they represent only 20 percent. The budget remains unchanged in either case, such that if everyone is treated in the public sector, the quality q^G would be equal to 4.

Under perfect information, the optimal subsidy and the quality in the public sector is higher when the share of poor is lower. In our example, $q^G(s^*) = 5.75$, and it drops to 4.43 when poor represent 80% of the population. The optimal subsidy changes from 2.29 to 0.83 as the share of poor increases. This result again illustrates the fact that it is cheaper to subsidize the private sector than to treat people in the public facilities. Having less poor individuals reduces the number of people that would get treated in the public sector if the subsidy policy takes place.

We show those result for the solidarity policy and separating contracts scenarios, but the analysis does not change, except for the scale of the potential benefits of applying the optimal subsidy.

Figure 1.7: Example different proportion rich poor

High proportion of poor High proportion of rich



1.5.3 Different proportions of healthy and sick

In figure 1.8, we change the proportion of sick and healthy people. On the left hand side, sick individuals only represent 20% of the population. On the right hand side, sick individuals represent 80 percent of the population. Changing the proportion of sick does not have any impact under perfect information (because B is standardized with respect to the number of illness episodes). The optimal subsidy is 2.60 and the quality in the public sector is 5.40, regardless of the proportion of healthy and sick.

Under the solidarity policy, we observe that with a low proportion of sick individuals, the equilibrium where healthy and sick rich are opting out for the private sector reports higher quality in the public sector, 5.16. When the sick rich are alone in the private sector, the quality in the public sector is only 4.43 units. The participation of both groups in the private sector makes the solidarity policy effective. In contrast, when the proportion of sick people is 80 percent, the quality in the public sector is going to be higher if only the sick rich are in the private sector, 5.22 compared to 4.41 when all the rich are seeking care through the private insurance.

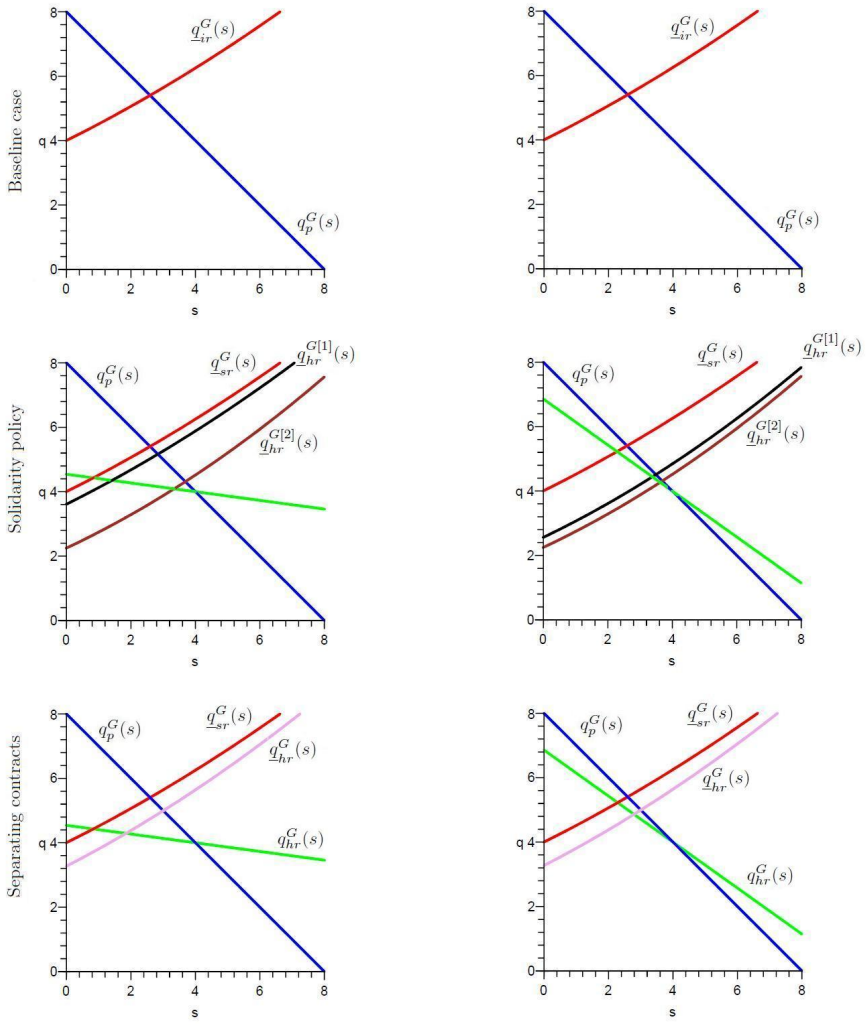
The separating contracts scenario shows a similar pattern. If the share of sick is high, the equilibrium with only sick people in the private sector reports higher quality in the public sector than having all rich in the private sector. And if the share of sick is low, the equilibrium with all the rich in the private sector is preferable.

Comparing the solidarity and the separating contracts scenarios, with a low share of sick people, the solidarity policy reports higher quality in the public sector and is Pareto superior. In contrast, if all rich people are in the private sector, a high share of sick people leads, in the separating contract scenario, to report higher quality in the public sector, which is better for the poor. This comes from the fact the MAQ for the healthy rich, when all rich individuals are in the private sector, is shifted toward the right in the solidarity policy scenario. In the separating contracts scenario, the same MAQ is independent of the share of healthy and sick people.

When there are few sick, it is interesting to note that the solidarity policy, putting barriers to efficiency in the private sector, leads to a higher public quality ($q^G(s^*) = 5.16$) than the separating contracts ($q^G(s^*) = 5.00$). It is therefore Pareto superior.

Figure 1.8: Example different proportion healthy sick

High proportion of healthy High proportion of sick



1.5.4 Different gap on the number of illness episodes between the healthy and sick individuals

We illustrate the implications of having a greater gap between the healthy and the sick in terms of illness episodes in figure 1.9. On the left hand side, the sick have 66% more illness episodes than the healthy, $\theta_s = 5$ and $\theta_h = 3$. On the right hand side, they only 11% more, $\theta_s = 5$ and $\theta_h = 4.5$.

Under perfect information, there is no change, as the gap between the healthy and sick increases. On the other hand in the solidarity policy and separating contracts scenarios, we observe drastic implications.

In the solidarity policy scenario, the distance between the MAQ for healthy and sick rich expands very fast, as the gap in the number of illness episodes increases. This makes it hard to convince the healthy rich individuals to opt out for the private sector. The subsidy is 4, the same as the cost of treating everybody in the public sector. If only sick rich are in the public sector, public quality becomes 4.98. This is better than giving incentives for the healthy rich to opt out for the private sector. The solidarity policy is not effective and everybody is worse off than in the perfect information scenario.

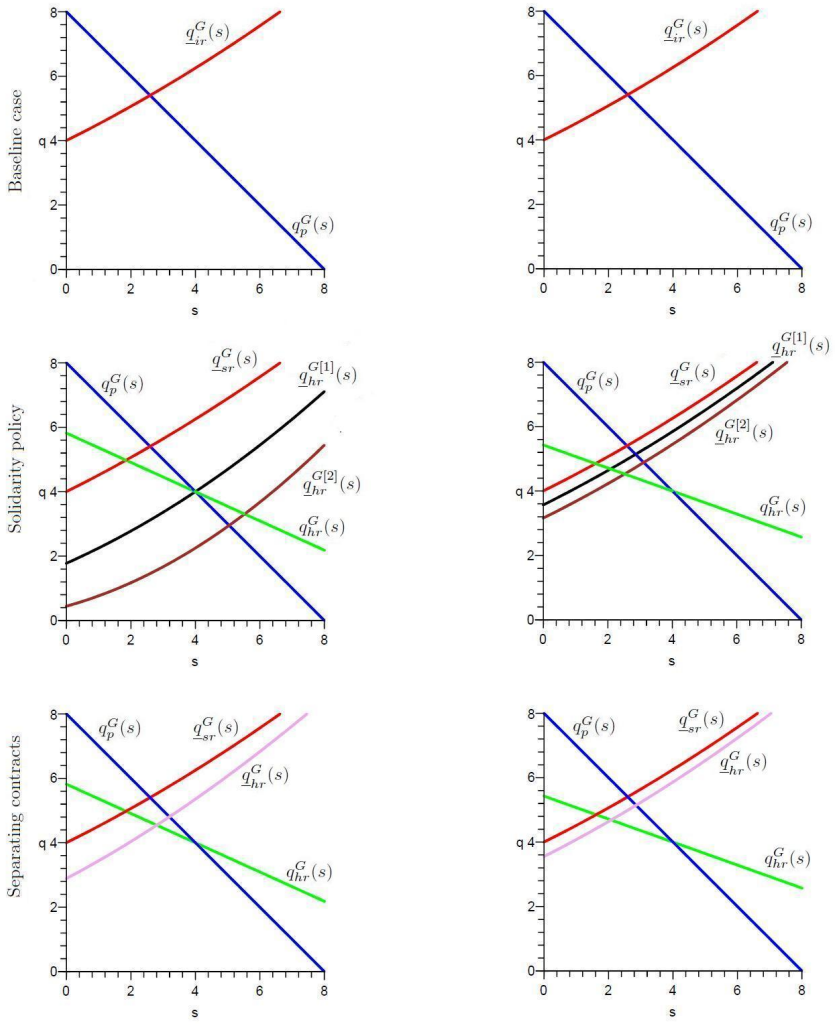
When the gap in the number of illness episodes is small, on the contrary, it is preferable, in terms of public quality, to induce the healthy rich to opt out as well. Quality becomes $q^G(s^*) = 5.14$ when the healthy rich are opting out, rather than 4.85 when they are getting treated in the public sector.

In the separating contracts scenario, the distance between the MAQ for the sick and healthy rich expands as the difference in the number of illness episodes increases. But this increase is slower than in the solidarity policy. The analysis remains comparable to the solidarity scenario.

If the gap in illness episodes is big, an effective solidarity policy is very costly in terms of public quality compared with a situation where only the sick rich are opting out. In this case, letting the market set up separating contracts is beneficial for the public quality. If the gap in illness episodes is small, the solidarity policy can be effectively implemented, leading to a higher public quality when all the rich opt out. However, the separating contracts scenario is still better.

Figure 1.9: Example different gap on the illness episodes

High difference in illness episodes | Low difference in illness episodes



1.6 Conclusion

In this chapter we analyzed the public provision of health insurance with heterogeneous agents (in wealth and health status) in a context where private and public providers coexist. Public provision is universal and free. Poor individuals have to rely on public services. Rich individuals may opt out to private providers by paying a premium. Quality is defined as health expenditures per illness episode.

We showed that under perfect information giving a subsidy to the private sector, such that no rich individual would demand public treatment, is Pareto improving, increasing the quality in the public sector which is better for the poor. If health status is not verifiable (asymmetric information), the maximum quality in the public sector is lower than in the perfect information case. It is not longer true that a subsidy that induces all the rich to opt out maximizes the quality in the public sector. It may be that the quality in the public sector is maximized with a subsidy where only the sick rich individuals get private insurance.

Under asymmetry of information, we studied scenarios where competition in contracts is prevented (solidarity policy) and permitted (separating contracts). Under the solidarity policy, the optimal level of subsidy is more sensitive to the proportion of sick and healthy people and to the difference in the number of illness episodes than under separating contract. Under separating contracts, a positive subsidy will reduce the costs of the healthy rich to signal themselves as good risks. If the level of subsidy is such that all rich are insured in the private sector, with a low proportion of sick people and low difference in illness episodes between sick and healthy, preventing competition in contracts is Pareto improving.

This result implies that the quality in the public sector, available to the poor, can be higher in a third best world than in a second best situation. A first-best situation is not achievable in this model due to fixed public budget and congestion in the public sector. In a second-best world, perfect information leads to all the rich opting out. With asymmetric information, it is possible to introduce redistribution from the healthy rich toward the poor and the sick rich. This depends on the proportion of healthy and sick individuals as well as on the difference in the number of illness episodes between the healthy and the sick.

We made some simplifying assumptions. First, our model relies on constant returns to scale technology for the production of quality. There are also only two wealth levels and two health statuses, rather than a continuum. There is perfect identification of an illness episode, for instance in terms of severity, or discretionary power of the physician. Changing some of those assumptions may have implications on our conclusions.

We discuss the implications of a public subsidy to private providers in terms of health insurance. This analysis could also apply to other domains, such as education, child care or elderly care.

This model permits to illustrate in a simple framework that public support to private providers can be justified. If a private good is an alternative to the public provision, a subsidy that reduces the price of the private alternative might free valuable resources. These resources can then be reinvested in the public provision, hopefully improving its quality.

1.7 Appendix

Lemma 1

The first best level of quality is independent of the health status.

The optimal quality maximizes the valuation of insurance over its costs, $v_{ij}(q) - c_{ij}(q)$. Because valuation is defined as $v_{ij}(q) = \theta_i \phi_j(q)$, the following holds true: $v_{hj} = \theta_h \phi_j(q) = \theta_h \frac{v_{sj(q)}}{\theta_s}$. This leads to $\frac{v_{hj}(q)}{\theta_h} = \frac{v_{sj}(q)}{\theta_s}$.

$$\begin{aligned} q^*_{hj} &= \underset{q}{\text{argmax}} \ [v_{hj}(q) - \theta_h q] \\ &= \underset{q}{\text{argmax}} \ \left[(v_{hj}(q) - \theta_h q) \left(\frac{\theta_s}{\theta_h} \right) \right] \\ &= \underset{q}{\text{argmax}} \ [v_{sj}(q) - \theta_s q] \\ &= q^*_{sj} \end{aligned}$$

Lemma 2

Under perfect competition, and no asymmetric information, private providers offer a fair premium and the first best quality for the rich.

Because of perfect competition, the zero-profit condition applies. This leads to, under perfect competition,

$$\Pi = P(q) - c(q) = 0$$

This implies fair premium.

Because of fair premium, any contract that does not maximize the surplus of quality over its costs will be suboptimal, and no agent will be interested in it. Only q^*_j can be offered. Because only the rich have access to the private market, only q^*_r can be supplied.

Lemma 3

Under fair prices, without asymmetric information, the minimum quality the rich individuals are accepting from the public sector $\underline{q}^G_{ir}$ is independent from the health status, $\underline{q}^G_{hr} = \underline{q}^G_{sr}$.

$\underline{q}^G_{hr}(s)$ and $\underline{q}^G_{sr}(s)$ are implicitly defined by the functions:

$$\begin{aligned} F^1(\underline{q}^G_{hr}, s) &= v_{hr}(\underline{q}^G_{hr}) - v_{hr}(q^*_r) + \theta_h(q^* - s) = 0 \\ F^2(\underline{q}^G_{sr}, s) &= v_{sr}(\underline{q}^G_{sr}) - v_{sr}(q^*_r) + \theta_s(q^* - s) = 0 \end{aligned}$$

Then, using as in Lemma 1 the condition that $\frac{v_{hj}(q)}{\theta_h} = \frac{v_{sj}(q)}{\theta_s}$:

$$\begin{aligned} F^1(\underline{q}^G_{hr}, s) &= v_{hr}(\underline{q}^G_{hr}) - v_{hr}(q^*_r) + \theta_h(q^* - s) \\ &= \left[v_{hr}(\underline{q}^G_{hr}) - v_{hr}(q^*_r) + \theta_h(q^* - s)\right]\left(\frac{\theta_s}{\theta_h}\right) \\ &= v_{sr}(\underline{q}^G_{sr}) - v_{sr}(q^*_r) + \theta_s(q^* - s) \\ &= F^2(\underline{q}^G_{sr}, s) \end{aligned}$$

Proposition 1

Under perfect risk selection and no subsidy, with public budget in a middle range ($B_1 < B < B_2$), part of the rich individuals are getting insurance in the private sector and the other part are getting insurance from the public sector. This means that $N^P < N_{hr} + N_{sr}$ and $N^G > N_{hp} + N_{sp}$. The quality in the public sector is equal to $\underline{q}^G_{ir}$.

If $B > B_1 = \underline{q}^G_{ir}(N_{hp} + N_{sp})$, and only the poor are supplied by the public sector, then $q^G = \frac{B}{N_{hp}+N_{sp}} > \underline{q}^G_{ir}$. This induces rich to enter the public sector.

If $B < B_2 = \underline{q}^G_{ir} N$ and all the population (rich and poor) are supplied in the private sector, then $q^G = \frac{B}{N} > \underline{q}^G_{ir}$. This induces rich to opt out for the private sector.

Therefore, for $B_1 < B < B_2$, using the fact that poor cannot opt out, there is necessarily a fraction of the rich in each sector, $N^P < N_{hr} + N_{sr}$ and $N^G > N_{hp} + N_{sp}$.

To maintain only a fraction of the rich in the both sectors, rich have to be indifferent between both sectors. From their indifference condition 1.5, $q^G = \underline{q}^G_{ir}$

Lemma 4

Under perfect risk selection and no asymmetry of information, it is always cheaper for the public sector to subsidize the rich so that they opt out for the private sector rather than treating them directly.

The subsidy needed to induce the rich to opt out is such that

$$v_{ir}(q^G(s)) = v_{ir}(q_r^*) - \theta_i(q_r^* - s)$$

The definition of first best quality q_r^* implies that,

$$v_{ir}(q_r^*) - \theta_i q_r^* \geq v_{ir}(q^G(s)) - \theta_i q^G(s)$$

Combining these equations implies

$$\begin{aligned} v_{ir}(q_r^*) - \theta_i q_r^* &\geq v_{ir}(q_r^*) - \theta_i(q_r^* - s) - \theta_i q^G(s) \\ \theta_i q^G(s) &\geq \theta_i s \end{aligned}$$

Strict inequality is ensured for $q^G(s) \neq q_r^*$. The budget condition $B < q_p^* N$ and the assumption that $v_{ir}(q) > v_{ip}(q)$ ensure it.

Lemma 5

The minimum acceptable quality in the public sector $\underline{q}_{ir}^G(s)$ increases with s at an increasing rate, $\frac{\partial \underline{q}_{ir}^G(s)}{\partial s} > 0$, and $\frac{\partial \underline{q}_{ir}^G(s)^2}{\partial^2 s} > 0$.

$\underline{q}_{ir}^G(s)$ is implicitly defined by

$$F^3(\underline{q}_{ir}^G, s) = v_{ir}(\underline{q}_{ir}^G) - v_{ir}(q^*) + \theta_i(q_r^* - s) = 0$$

The implicit function theorem and the assumptions that $\frac{\partial v_{ij}(q)}{\partial q} > 0$ and $\frac{\partial^2 v_{ij}(q)}{\partial q^2} < 0$ imply that

$$\begin{aligned} \frac{\partial \underline{q}_{ir}^G(s)}{\partial s} &= \frac{-\frac{\partial F^3(\underline{q}_{ir}^G, s)}{\partial s}}{\frac{\partial F^3(\underline{q}_{ir}^G, s)}{\partial \underline{q}_{ir}^G}} = \frac{\theta_i}{v_{ir}(\underline{q}_{ir}^G(s))'} > 0 \\ \frac{\partial^2 \underline{q}_{ir}^G(s)}{\partial s^2} &= \underbrace{-\theta_i}_{<0} \underbrace{\left[v_{ir}\left(\underline{q}_{ir}^G(s)\right)'\right]^{-2}}_{>0} \underbrace{v_{ir}(\underline{q}_{ir}^G(s))''}_{<0} > 0 \end{aligned}$$

Proposition 2

Under perfect risk selection, a subsidy s^*, defined as $\underline{q}_{ir}^G(s^*) = q_p^G(s^*)$, maximizes the objective function of the government. For $s^* > 0$, it is also an improvement in a Pareto sense over the no subsidy case

The maximization program of the government is as follows

$$\begin{aligned} max_s q^G(s) & \\ s.t. \quad & q^G(s) \leq \underline{q}_{ir}^G(s) \\ & q^G(s) \leq q_p^G(s) \end{aligned}$$

Because of lemma 5 (MAQ increases with s) and the fact that $q_p^G(s)$ decreases linearly with the subsidy s, $\underline{q}_{ir}^G(s)$ and $q_p^G(s)$ have a single crossing point, $(s, q^G(s))$. The maximum attainable q^G is the crossing point.

If $s^* > 0$ maximizes the objective function of the government, $q^G(s^*) > q^G(0)$. The poor are better off. Because the utility of the rich is identical, irrespective of the sector the seek insurance from (from the MAQ), an increase in public quality q^G is also beneficial for them. If the optimal subsidy is positive, it is an improvement in a Pareto sense.

Lemma 6

Under a solidarity policy, the minimum acceptable qualities $\underline{q}_{hr}^{G[1]}(s)$ and $\underline{q}_{hr}^{G[2]}(s)$ in the public sector for the healthy rich are increasing and convex in s. At any subsidy level s, we have that $\underline{q}_{sr}^G(s) > \underline{q}_{hr}^{G[1]}(s) > \underline{q}_{hr}^{G[2]}(s)$.

$\underline{q}_{hr}^{G[1]}(s)$ is implicitly defined by

$$F^4(\underline{q}_{hr}^{G[1]}, s) = v_{hr}(\underline{q}_{hr}^{G[1]}) - v_{hr}(q_r^*) + \frac{N_{sr} + N_{hr}}{M_{sr} + M_{hr}}(q_r^* - s) = 0$$

The implicit function theorem and the assumptions that $\frac{\partial v_{ij}(q)}{\partial q} > 0$ and $\frac{\partial^2 v_{ij}(q)}{\partial q^2} < 0$ imply the result as in Lemma 5.

$\underline{q}_{hr}^{G[2]}(s)$ is implicitly defined by

$$F^5(\underline{q}_{hr}^{G[2]}, s) = v_{hr}(\underline{q}_{hr}^{G[2]}) - v_{hr}(q_r^*) + \theta_s(q_r^* - s) = 0$$

The implicit function theorem and the assumptions that $\frac{\partial v_{ij}(q)}{\partial q} > 0$ and $\frac{\partial^2 v_{ij}(q)}{\partial q^2} < 0$ imply the result as in Lemma 5.

From Lemma 3, $\underline{q}_{sr}^G = \underline{q}_{hr}^G$ where $\underline{q}_{hr}^G$ is defined in the perfect information (baseline) setting, implicitly from $F^1(\underline{q}_{hr}^G, s) = v_{hr}(\underline{q}_{hr}^G) - v_{hr}(q_r^*) + \theta_h(q^* - s) = 0$. Because $\theta_h < \frac{N_{sr}+N_{hr}}{M_{sr}+M_{hr}} < \theta_s$, and because $\frac{\partial v_{ij}(q)}{\partial q} > 0$, we have $\underline{q}_{sr}^G(s) > \underline{q}_{hr}^{G[1]}(s) > \underline{q}_{hr}^{G[2]}(s)$.

Proposition 3

There are two potential equilibria, at s_1^*, where the healthy rich are in the public sector, and s_3^*, where all the rich are opting out. If and only if $\underline{q}_r^{G[1]}(s_3^*) \geq \underline{q}_{sr}^{G}(s_1^*)$, then s_3^* is Pareto dominating s_1^*.

If only the sick rich are in the private sector, the maximization program of the government is as follows

$$\begin{aligned} max_s q^G(s) & \\ s.t. \quad & q^G(s) \leq \underline{q}_{sr}^G(s) \\ & q^G(s) \leq q_h^G r(s) \end{aligned}$$

Because of lemma 5 (MAQ increases with s) and the fact that $q_{hr}^G(s)$ decreases linearly with the subsidy s, $\underline{q}_{sr}^G(s)$ and $q_{hr}^G(s)$ have a single crossing point, $(s, q^G(s))$. The maximum attainable q^G is the crossing point.

If all the rich (healthy and sick) are in the private sector, the maximization program of the government is as follows

$$\begin{aligned} max_s q^G(s) & \\ s.t. \quad & q^G(s) \leq \underline{q}_{hr}^{G[1]}(s) \\ & q^G(s) \leq q_p^G(s) \end{aligned}$$

Because of lemma 6 (MAQ increases with s) and the fact that $q_p^G(s)$ decreases linearly with the subsidy s, $\underline{q}_{hr}^{G[1]}(s)$ and $q_p^G(s)$ have a single crossing point, $(s, q^G(s))$. The maximum attainable q^G is the crossing point.

Poor are getting utility associated with public quality. The pivotal agents (healthy rich when they are getting private insurance, sick rich when healthy rich are getting public insurance) are getting the exact same utility out of the public and the private sector quality (indifference conditions). Sick rich are better off when subsidized (through risk pooling) by the healthy rich. Therefore, if $\underline{q}_r^{G[1]}(s_3^*) > \underline{q}_{sr}^G(s_1^*)$, an equilibrium where the healthy rich are subsidizing the sick rich, at subsidy s_3^*, is Pareto dominant.

Lemma 7

Under risk selection with asymetric information, the sick rich are getting their first-best level of quality, q_r^* at a fair premium $P(q_{sr}) = \theta_s(q_r^* - s)$. The healthy rich are getting quality $\overline{q}_{hr}(s)$ at a fair premium $P(q_{hr}) = \theta_h(\overline{q}_{hr}(s) - s)$. The decrease in quality incurred by the healthy rich to signal themselves as good risks is reduced by the subsidy.

At quality level $\overline{q}_{hr}(s)$ and fair premium $P(\overline{q}_{hr}(s)) = \theta_h(\overline{q}_{hr}(s)-s)$ (in the private sector), we have the following incentive compatibility constraints

$$\begin{aligned} v_{sr}(\overline{q}_{hr}(s)) - \theta_h(\overline{q}_{hr}(s)-s) &\leq v_{sr}(q_r^*) - \theta_s(q_r^*-s) \\ v_{hr}(q_r^*) - \theta_s(q_r^*) &\leq v_{sr}(\overline{q}_{hr}(s)) - \theta_h(\overline{q}_{hr}(s)-s) \end{aligned}$$

Healthy rich are buying the contract $(\overline{q}_{hr}(s), P(\overline{q}_{hr}(s)))$, and are not interested in $(q^*, \theta_s(q^*-s))$.
Sick rich are not interested in $(\overline{q}_{hr}(s), P(\overline{q}_{hr}(s)))$ if their optimal contract $(q^*, \theta_s(q^*-s))$ is available. Because of competition in contracts, a pooling contract cannot be a stable equilibrium.
$\overline{q}_{hr}(s)$ is implicitly defined by

$$F^6(\overline{q}_{hr}, s) = v_{sr}(\overline{q}_{hr}) - \theta_h(\overline{q}_{hr}-s) - v_{sr}(q_r^*) + \theta_s(q_r^*-s) = 0$$

The implicit function theorem and the assumptions that $\frac{\partial v_{ij}(q)}{\partial q} > 0$ and $\frac{\partial^2 v_{ij}(q)}{\partial q^2} < 0$ together with $\theta_h < \theta_s$ imply that

$$\begin{aligned} \frac{\partial \overline{q}_{hr}(s)}{\partial s} &= \frac{-\frac{\partial F^6(\overline{q}_{hr},s)}{\partial s}}{\frac{\partial F^6(\overline{q}_{hr},s)}{\partial \overline{q}_{hr}}} = \frac{-(\theta_h-\theta_s)}{v_{sr}(\overline{q}_{hr}(s))' + \theta_h} > 0 \\ \frac{\partial^2 \overline{q}_{hr}^G(s)}{\partial s^2} &= \underbrace{(\theta_h-\theta_s)}_{<0}\underbrace{[v_{sr}(\overline{q}_{hr}(s))'+\theta_h]^{-2}}_{>0}\underbrace{v_{sr}(\overline{q}_{hr}(s))''}_{<0} > 0 \end{aligned}$$

Lemma 8

Under risk selection with asymetric information, the minimum acceptable quality in the public sector for the healthy rich is increasing with s at an increasing rate, $\frac{\partial \underline{q}_{hr}^G(s)}{\partial s} > 0$. *Healthy rich are pivotal,* $\underline{q}_{sr}^G(s) > \underline{q}_{hr}^G(s)$
$\underline{q}_{hr}^G(s)$ is implicitly defined by

$$F^7(\underline{q}_{hr}^G, s) = v_{hr}(\underline{q}_{hr}^G) - v_{hr}(\overline{q}_{hr}(s)) + \theta_h(\overline{q}_{hr}(s)-s) = 0$$

The implicit function theorem and the assumptions that $\frac{\partial v_{ij}(q)}{\partial q} > 0$ and $\frac{\partial^2 v_{ij}(q)}{\partial q^2} < 0$, together with Lemma 7 imply that

$$\frac{\partial \underline{q}_{hr}^G(s)}{\partial s} = \frac{-\frac{\partial F^7(\underline{q}_{hr}^G,s)}{\partial s}}{\frac{\partial F^7(\underline{q}_{hr}^G,s)}{\partial \underline{q}_{hr}^G}} = \frac{(v_{hr}(\overline{q}_{hr}(s))' - \theta_h)\frac{\partial \overline{q}_{hr}(s)}{\partial s} + \theta_h}{v_{hr}(\underline{q}_{hr}^G(s))'} > 0$$

From Lemma 3, $\underline{q}_{sr}^G = \underline{q}_{hr}^G$ where $\underline{q}_{hr}^G$ is defined in the perfect information (baseline) setting, implicitly from $F^1(\underline{q}_{hr}^G, s) = v_{hr}(\underline{q}_{hr}^G) - v_{hr}(q_r^*) + \theta_h(q^*-s) = 0$. Because $v_{hr}(q_r^*) - \theta_h(q^*-s) > v_{hr}(\overline{q}_{hr}(s)) - \theta_h(\overline{q}_{hr}(s)-s)$, and because $\frac{\partial v_{ij}(q)}{\partial q} > 0$, we have $\underline{q}_{sr}^G(s) > \underline{q}_{hr}^G(s)$.

Proposition 4

There are two potential equilibrium, at s_1^*, where the healthy rich are in the public sector, and s_2^*, where all the rich are opting out. If and only if $\underline{q}_{hr}^G(s_2^*) \geq \underline{q}_{sr}^G(s_1^*)$, then s_2^*, where the healthy rich are participating in the private market, is Pareto dominating s_1^*, where the healthy rich are receiving public insurance.

If only the sick rich are in the private sector, the maximization program of the government is as follows

$$\begin{aligned} max_s q^G(s) & \\ s.t. \quad & q^G(s) \leq \underline{q}_{sr}^G(s) \\ & q^G(s) \leq q_h^G r(s) \end{aligned}$$

Because of lemma 5 (MAQ increases with s) and the fact that $q_h^G r(s)$ decreases linearly with the subsidy s, $\underline{q}_{sr}^G(s)$ and $q_h^G r(s)$ have a single crossing point, $s, q^G(s)$. The maximum attainable q^G is the crossing point.

If all the rich (healthy and sick) are in the private sector, the maximization program of the government is as follows

$$\begin{aligned} max_s q^G(s) & \\ s.t. \quad & q^G(s) < \underline{q}_{hr}^G(s) \\ & q^G(s) < q_p^G(s) \end{aligned}$$

Because of lemma 8 (MAQ increases with s) and the fact that $q_p^G(s)$ decreases linearly with the subsidy s, $\underline{q}_{hr}^G(s)$ and $q_p^G(s)$ have a single crossing point, $s, q^G(s)$. The maximum attainable q^G is the crossing point.

Table 1.1: Example values

	Budget change		Proportion rich/poor		Proportion healthy/sick		Illness gap healthy/sick	
	Low	High	Few rich	Few poor	Few sick	Few healthy	Big gap	Small gap
s^*	-1.628	2.596	1.298	3.513	2.596	2.596	2.596	2.596
$q^G(s^*)$	3.228	5.404	4.675	5.745	5.404	5.404	5.404	5.404
s_1^*	-3.484	1.689	0.834	2.286	0.834	2.286	1.849	1.619
$q_1^G(s^*)$	2.448	4.889	4.428	5.224	4.428	5.224	4.978	4.85
s_2^*	-1.394	3.503	3.342	3.623	3.342	3.623	5.527	2.521
$q_2^G(s^*)$	1.644	4.191	4.089	5.161	4.089	4.269	3.306	4.528
s_3^*	-0.993	3.175	2.451	3.71	2.837	3.383	4	2.863
$q_3^G(s^*)$	2.593	4.825	4.387	4.269	5.163	4.441	4	5.137
s_4^*	-1.12	3.005	2.142	3.648	3.005	3.005	3.196	2.856
$q_4^G(s^*)$	2.72	4.995	4.464	5.408	4.995	4.995	4.804	5.144

s^* and $q^G(s^*)$ refer to the baseline (perfect information) case.
s_1^* and $q_1^G(s^*)$ refer to the asymmetry of information scenario (solidarity or separating), when the health rich are treated in the public sector.
$*s_2^*$, s_3^*, $q_2^G(s^*)$ and $q_3^G(s^*)$ refer to the solidarity scenario, when all the rich are opting out.
s_4^* and $q_4^G(s^*)$ refer to the separating contracts scenario, when all the rich are opting out.

Chapter 2

Differences in health insurance costs across Swiss cantons

2.1 Introduction

Switzerland is the third country (after the United States and France) in terms of the share of resources devoted to health care. In 2007, the health care costs are estimated to amount for 10.6% of GDP[1]. This proportion has been increasing over time, even though, in more recent years, it seemed to stabilize. Health care costs are thus giving rise to important political and public discussions.

At the national level, health care financing is divided into several actors. Social insurance is the biggest source of financing (42.9% in 2007). The most important part of social insurance is the compulsory health insurance. Direct out-of-pocket payments from household (30.7%) are another important source. The State is subsidizing the providers directly for 16.2% of the health costs. This financing is coming essentially from the cantons (local state), the federal state contributing only up to a small fraction. Private insurance (9.2%) and some small other contributors (1%) make up for the remaining.

Switzerland is divided into 26 cantons, each having a local government. The cantons are relatively independent from each other and from the central government. However, most of the important institutional regulations are uniform in the whole Confederation. Among others, the social health insurance is nationally implemented.

At the same time, the 26 Swiss cantons are very different. Size, population, socio-economic conditions can vary in an important way. In terms of health care costs, in particular, they are very unequal. The costs reimbursed by the social health insurance per insured, vary

[1]Source: Swiss Federal Statistical Office.

in 2007 from 1555 to 3343 Swiss Francs. Health insurance premia are an important compulsory spending for Swiss households. The costs paid by health insurance are the object of important public debates. Health insurance expenditures also the part of health costs that expand the fastest. Public health authorities in the most expensive cantons are devoting an important amount of time and effort to understand the differences between cantons.

This work is aimed at understanding the differences in health insurance expenditures between cantons. At the same time, it proposes to examine the possible determinants of these health insurance costs. Studying a single country eliminates some of the problems encountered usually in this kind of work. The institutional setting (at least in terms of health care) and the currency used are identical from one canton to the other. But there are also tremendous differences on other variables. Medical density, density of the population and of course health care costs to name a few may vary importantly between cantons.

In this work, the dependent variables, health insurance expenditures, are measured in two different ways. First, they are measured in levels (Swiss Francs per insured individual), including the expenditures for ambulatory care, inpatient care, elderly care and drugs specifically. They are then measured as the fraction of the expenditures devoted to each element, as a fraction of total health insurance expenditures. As for explanatory variables, health insurance expenditures are explained, taking into account the panel dimension of the data, by medical supply variables (density of physicians, of hospital beds), organization of ambulatory care (physicians self-dispensing drugs, hospital involvement in ambulatory care providing) and insurance market (deductible choice), socio-economic variables (income, education), and controlling for the demographic structure of the population, as well as a time trend. Contrary to previous work, the model also controls for possible endogeneity of the density of physicians and the deductible choice in the compulsory health insurance plan. Both these variables could be influenced by other explanatory variables (physicians settling near big hospitals, or choice of deductible being influenced by income, for instance).

The analysis is limited to compulsory health insurance costs, due to data availability. These are only a fraction of the total health costs. However, they are highly correlated with total costs ($\rho > 0.9$ at the national level). These data also permit to study the costs by type of care (ambulatory, inpatient, drugs and elderly home care), by canton. In addition, as highlighted above, health insurance is the part of the health care costs that generates the most fierce public debates, due to the premia being very visible.

The explanatory variables having a significant positive effect on the health insurance costs are the physicians density and the importance of ambulatory care in the hospital. The propharmacy behavior (physicians dispensing drugs directly) and surprisingly income have a negative significant impact. Education, the proportion of the population choosing the minimum possible deductible and the time trend also have an impact on several elements of the costs, even if their effect is not significant on total costs.

In this work, I extend the analysis done by other authors, notably on Switzerland in two directions. First, I am taking into account the potential endogeneity of the medical density, as well as of the choice of health insurance deductible. Second, I decompose the health insurance costs into four different elements, ambulatory care, inpatient care, drugs and elderly care costs. The impact of the exogenous variables on these specific costs is different than their impact on total costs.

The following section describes the existing literature on health costs determinants. A subsequent section describes the Swiss institutional setting. I then turn to the models and their results, before concluding.

2.2 Literature

When trying to explain health care costs at an aggregate level, the international literature in economics has focused on explaining differences between countries. Most of the work has been devoted to differences between OECD countries, due to data availability. Their results highlight the importance of GDP per capita in the explanation of health costs differences.

In his seminal paper, Newhouse (1977) examines the relationship between a country's medical-care expenditure and its income. He uses cross-sectional data on 13 developed countries in the early 1970's. His results explain over 90% of the variance in the per capita medical expenditure with only variations in per capita GDP. The estimated coefficient implies an income elasticity of health care expenditures greater than one. He thus concludes that factors other than income are of marginal significance and that health care is a luxury good. Even though this last statement has been widely debated, most of the early empirical research has confirmed Newhouse's result (see Gerdtham and Jönsson, 2000, for a review). Most of these studies have been criticized for the smallness of the data set employed, as well as for the implicit assumption that health care is homogeneous in the different countries studied.

As highlighted by several authors (Blomqvist and Carter, 1997, Roberts, 2000, Herwartz and Theilen, 2003), a common trend and a common income elasticity cannot be assumed across countries. A large number of studies have then been conducted using panel data techniques. Using data for countries of the OECD for long time period, most of these studies conclude that GDP is one of the major explanatory variable for health care expenditures (Hitiris and Posnett, 1992, Hitiris, 1997, Gerdtham et al., 1998, Pita Barros, 1998).

Very few papers have been investigating the determinants of health costs outside OECD countries. Musgrove et al. (2002) analyze the national health accounts for 191 WHO member states in 1997, using the GDP as an explanatory variable. They showed an income elasticity above one in most of the cases.

Some authors have been examining health expenditures inside a country. Di Matteo and Di Matteo (1998) look at pooled time-series data for the period 1965-1991 in the provinces of Canada. They find that the income elasticity of health care costs is significantly different from zero, but lower than one. The proportion of elderly and federal transfers to provinces also have significant effects.

Di Matteo (2003), for United States and Canada, uses nonparametric estimation of the income elasticity of health care expenditures at different income levels. He suggests that income elasticity is higher at low income levels. He also finds that international income elasticities are typically larger than what is found by regional or national studies. Di Matteo (2005), for the same countries, finds that aging of population and income account for a small proportion of the explanation of health costs, especially when a time trend (interpreted as technology change) is taken into account. More recently, the Dartmouth Atlas Study examines the differences in regional health care spending in the United States. Fisher et al. (2009) highlight that technology is an insufficient explanation for the growth in health care costs. Once accounted for differences in prices, the most important factor is, according to them, medical practice. The Dartmouth Atlas Study also documents differences in quality of care, delivery systems and the providers payment system, health status, as well as detailed information on specific procedures.

Koenig et al. (2003) examines state-level physician cost data from Medicare and Medicaid (United States). He finds that, aside from inflation, economic and demographic variables are the most important factors explaining these costs, while supply variables and technology patterns are also important.

Bilgel (2003) examines Turkish data for the period 1927-1996. He corrects for possible non-stationarity of the data. He finds that the income elasticity of health care costs is lower than one, while the proportion of elderly and education are not significant.

Giannoni and Hitiris (1999) look at Italian data to assess the effect of decentralization on interregional divergences and inequality. They show that the most important determinant of regional health expenditures is regional income, aging of population, while structural characteristics (productivity...) are of lesser importance. Supply side variables (hospital beds) are also important. Sutton and Lock (2000) find similar results for Scotland.

Dormont and Huber (2006) use micro-simulation on French data to show the importance of medical practice, while the rise in expenditures due to aging is relatively small.

Crivelli et al. (2006) are looking at Swiss data to assess the impact of federalism on per-capita cantonal expenditures. They look at several economic (income, poverty rate, unemployment), demographic (age, mortality, population density, index for direct democracy, dummy for Latin canton) and supply factors (physician and hospital beds density), in a log-log form. Some of their variables are time-invariant over their estimation period. They prefer a random-effect model of the cantonal specific characteristics (still introducing a dummy for Latin cantons, which turns out to be statistically significant). Their

results show the impact of physicians density, but not of hospital beds. They find a negative, but not significant, effect of income. Time trend is also critical. Other economic variables (poverty, unemployment) and other cantonal characteristics are not significant. They do not take into account the potential endogeneity of the medical density variables, as they are focusing on a single equation framework. Furthermore, they analyze "'socialized health expenditures"', a combination of public health expenditures and costs of the compulsory health insurance. They focus on the total health expenditures, not braking them in their components.

Reich et al. (2010) also examine the Swiss data in order to assess the determinants of health care expenditures. Again, they use a single equation log-log model, but prefer cantonal fixed effects. The explanatory variables the consider are economic (income, unemployment), demographic (age, density, density of the foreign population, tobacco consumption) and supply-side oriented (physician and specialist density, hospital beds density, density of pharmacies, importance of dispensing doctors, share of managed care insurance contracts). They find an important impact of the organization of ambulatory care delivery (share of managed care insurance contracts, specialists density, dispensing doctors), as well as unemployment, foreign population and time trend. There is a significant negative impact on costs of the proportion of the population choosing a managed care insurance plan and, surprisingly, of income. Again, their single equation framework does not allow them to consider potential endogeneity. Their dependent variable comprises basic health insurance costs, public expenditures as well a cost-sharing part. As in Crivelli et al. (2006), they do not investigate the various components of health expenditures.

Newhouse (1992) is questioning the effect of medical technology improvement in the United States. He observes that it is an important factor of health care costs increase. A similar study on Swiss data by Lamiraud and Lhuillery (unpublished) also highlights the importance of medical technology on costs. In this study, income and unemployment have also an impact on the costs, together with the proportion of elderly, the density in specialist physicians and the choice of insurance deductible.

Several authors have been calling for a strengthening of the theoretical base from which to analyze health spending. Very few papers try explicitly to model it. Clemente et al. (2004) analyze separately private and public health expenditures. They build a model where a Cobb-Douglas utility function and a particular tax scheme lead to an income elasticity of both government and private household with respect to health expenditures bigger than one. Hartwig (2008) builds on the Baumol model of "'unbalanced growth"'. As Baumol, he assumes that health care is labor intensive, and thus does not benefit from technological progress (which is questionable). He then shows that an ever larger share of labor should be allocated to the production of a price-inelastic[2] non-progressive good such as health care, leading to an increase of its value as a share of nominal GDP. He then regressed health care expenditures on the difference between wage growth rates and productivity and finds that his model is supported by the data.

[2]As is supported by the data for individuals as opposed to aggregate expenditures

2.3 The Swiss health care system

My goal is to explicit health care costs determinants in a panel data framework.

To measure health expenditures per canton, I use compulsory health insurance costs per capita. Health insurance in Switzerland is organized around two types of coverages, social health insurance and supplementary insurance.

The so-called basic insurance, constituting the large majority of social health insurance, is compulsory for all residents since 1996. It must be purchased from one of the (competitive) insurers providing it in the canton. The coverage is legally defined and is homogeneous among health plans. Insurers that offer a basic health insurance contract in a given area are complied to accept any applicant. The premium is fully paid by the insured even though, in some cases, a public subsidy can intervene. Premia are community-rated and do not reflect individual risk. They have to be identical in a given geographical area (up to three per canton). They are fixed by the insurers, but subject to approval by a federal authority.

The social insurance contract includes a deductible, chosen by the insured[3]. There exists also an option to reduce one's premium by choosing some form of gatekeeping before access to care[4].

The social insurance costs are, as stated earlier, widely spread across the cantons. From the lowest canton (Appenzell Inner-Rhoden, 1555 CHF per year per insured in 2007) to the most expensive one (Basel Stadt, 3343 CHF), the ratio is superior to $1:2$.

Supplementary health insurance, on the other hand, is purchased on a voluntary basis. The product can be freely defined and risk selection is allowed. Competition can take place in both product and price.

Public subsidies, the part of health directly financed by the local and national states, are dedicated to the providers of a given canton. They also account for a large part of the health care financing. This is also the case for households' out-of-pocket expenditures.

[3]Among the existing possibilities. The possible deductibles have changed in 2005, to include higher deductibles options. They now range from 300 to 2'500 CHF.

[4]This can take the form of an obligation to see a general practitioner before visiting a specialist, or the necessity to phone a call center before any medical visit.

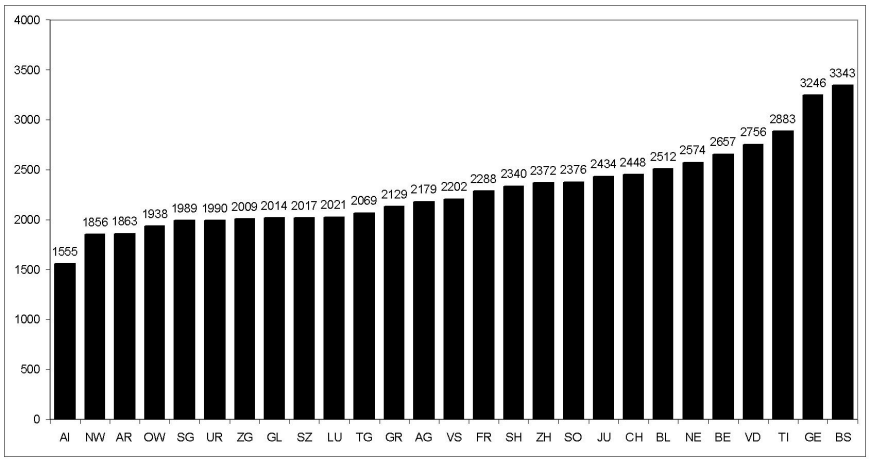
2.4 Data

I consider a panel of the 26 swiss cantons during 7 years (2001-2007). The main variable of interest is the compulsory health insurance costs. I also consider the type of care's specific costs (ambulatory care, inpatient care, drugs, elderly home). All the variables are considered at the aggregated cantonal level.

Compulsory health insurance is the main social health insurance in Switzerland. It covered 35.3% of the total health costs in Switzerland in 2007. The other modes of health care financing in Switzerland are not considered, either for data availability reasons, or because of comparability issues. As all the inhabitants have access to providers in any cantons (some of them being very small), public subsidies to local facilities are not a good measure of health care costs generated by the citizens of a given cantons. They also include expenditures for prevention, as well as subsidies not directly related to health care providing (for instance research and teaching in university hospitals). Comparability of the public subsidies across cantons is therefore difficult. Out-of-pocket expenditures are the other important part of the health costs financing, but data are not available by canton. In the same way, private (supplementary) insurance expenditures data are not publicly available. Considering only compulsory health insurance also permits to consider separately the costs of the different types of care. This decomposition is not available for the other sources of financing. In addition, health insurance is one of the most debated political topics in Switzerland, mainly because its costs are seen as particularly important. Therefore, even if total health costs and social health insurance expenditures are very highly correlated at the national level, this work does not discuss the determinants of the total health costs in Switzerland.

The health insurance costs vary widely across Swiss cantons. In the canton where the costs are the lowest (Appenzell Inner-Rhoden, AI), they are more than two times less important than in the canton where they are the highest (Basel Stadt, BS). Health insurance costs are standardized per insured individual.

Figure 2.1: Health insurance costs, per insured, by canton, CHF 2007



Because of this massive discrepancy and because of their particular relevance for policy discussed earlier, it is particularly interesting to focus on health insurance costs, the first independent variable that is analyzed. Costs, decomposed by type of care (ambulatory care, stationary care, elderly care and drugs[5]) vary also in an important way across cantons, and will be analyzed as 5 different dependent variables. It is often the case that a canton where health costs are globally low faces low costs in most of these types of care. However, the share of costs attributed to every type of care is also differentiated across cantons. The share of costs will be analyzed separately, again as 5 different dependent variables.

The data concerning the health insurance expenditures come from the health insurers themselves. A governmental organization (Obsan) compiles these data, and transmits them. Most of the insurers (representing more than 90% of the insured for every year considered in this analysis) participated in the collection of the data. The missing fraction of the data has been extrapolated. These data are highly representative of the total health insurance expenditures.

The models that will be estimated will take into account potential endogeneity of two variables, the density of physicians and the choice of deductible by the insured. While I am more interested in the effects of these variables on the costs, these two variables are dependent in the model. We identify their respective effects using instrumental variable.

[5]For completeness, an "'other"' category will also be analyzed. This takes into account several heterogeneous services, such as physiotherapy, home care, laboratories, etc.

- *An imposition index*[6] (Source: Federal Statistical Office). It is constructed as a weighted average of the tax rates. Physicians are not willing to settle where the tax rate is too high.

- *The density of students in medical school coming from a given canton.* It is measured as the density for 1'000 individuals. The students in medical school have a tendency to settle back in the canton they originates from. Under the assumption of a certain inertia in the density of physicians, the density of physicians will be linked to this number of students.

- *An Herfindhal index of competition in the (compulsory) insurance market (per canton), together with the number of insurers active in the canton* (Source: Health insurers, via Obsan). If the competition is fiercer in the insurance market the premia will diminish. Therefore, the incentive to choose a low deductible in order to reduce the premium for an individual is lowered.

Potential explanatory variables are listed below. Most of these variables are suggested by the literature. The possible supply effects we consider are the following:

- *levels of supply* (Source: Federal Statistical Office). In the case where more providers are present, a canton may experience higher health care costs. In this respect, I consider the density of physicians and of hospital beds, both measured as the density for 1'000 insureds. This can be interpreted as physicians' discretionary power on the quantity of care (including supply induced demand), or as an indication that supply matches higher demand.

- *the effects of medical practices* (Source: Health insurers, via Obsan). An important difference between Swiss cantons is in the drug providing mode. While some cantons observe drug distribution only through pharmacies, a number of others see the physicians dispensing the drugs they prescribe directly to the patient (propharmacy behavior). It is measured as the proportion of the costs devoted to drugs that are enforced by physicians. It can have two effects. While this "'direct distribution"' can enhance the efficiency of the health care provision, it can also lead to over-distribution of drugs. It is sometimes argued that physicians have a "'target income"' that they try to reach. When drug dispensing can make up some part of this target income, it will also reduce the fees paid for consultation.

- *Ambulatory care in the hospitals* (Source: Health insurers, via Obsan). The Swiss cantons are also vastly different in terms of the proportion of outpatient (or ambulatory) care provided directly by hospitals. Outpatient care is less costly than inpatient care, it is thus profitable that hospitals provide more outpatient care instead of

[6]This imposition index is computed in R. Parchet and M. Brülhart, Alleged Tax Competition : the Mysterious Death of Inheritance Taxes in Switzerland (unpublished). It mainly relies on inheritance tax, but incorporates other tax rates.

inpatient care. On the other hand, it is also more costly to provide ambulatory care in an hospital rather than by free-practice physicians, so a transfer of ambulatory care providing from the installed physicians to the hospital is detrimental to costs. The overall effect on costs of higher outpatient care is ambiguous. We measure it as the proportion of ambulatory care (physicians and outpatient care in hospitals) provided by hospitals.

We consider the following demand variables:

- *average income available to households*[7] (Source: Federal Statistical Office). In the cross-countries analysis, it is reported to be the single most important explanatory variable. Higher income is usually expected to lead to higher costs, even though Reich et al. (2010) have found a negative impact in Switzerland, potentially reflecting health status. Income is measured in thousands Swiss francs (CHF) per household.

- *education* (Source: Federal Statistical Office). This variable, together with income, accounts for the socio-economic status. Highly educated individuals are generally considered to be in better health condition. But their higher socio-economic status leads them to consume more health services. The effect is ambiguous. It is measured as the average number of year of education completed by the population of the canton.

- *Minimum deductible choice* (Source: Federal Office for Public Health). This variable accounts for self-perceived health status (expected to reduce costs), but will also captures some of the socio-economic influence. It is measured as the proportion of the population choosing the minimum available deductible among the existing possibilities.

- *Index for demographic structure* (Source: own computation from databases from the Federal Office for Public Health and the Federal Statiscal Office). This index measures the demographic structure via inpatient services use. From a representative database collected by the Federal Office for Public Health, the inpatient use by demographic profile (age and sex) is measured for Switzerland. A national average length of stay (by individual) is computed (l_{CH}). Given its demographic structure, a theoretical average length of stay (by individual) is computed for each canton (l^t_{canton})[8]. The index then used in the analysis is the ratio of the cantonal theoretical length of stay, divided by the national length of stay, $I = \frac{l^t_{canton}}{l_{CH}}$. It is an index of "'bad demographics"', as larger value denotes a demographic structure that requires on average a larger inpatient use, relative to what is observed elsewhere in the country. It is, obviously, expected to increase costs. Straight demographic classes

[7] Which is not GDP. There are no good measures of GDP per canton.

[8] The theoretical length of stay is different from the actual length of stay. In particular, it is a measure cleared from the effects of intercantonal differences in medical practices.

could also be used as controls. However, they increase importantly the explanatory variables count. Because of the limited number of observations, this composite index (a single variable) controls for the demographics profile of the population, weighted by inpatient use, of a canton in a given year, and reduces the number of parameters to estimate.

All the variables are listed together with their summary statistics in the table 2.1 below. The correlation displayed is with total health insurance costs. Every variable measured in monetary units (including health costs) is adjusted at 2007 prices.

Table 2.1: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Corr.**	**Min**	**Max**
Total costs	2'123.47	447.12	1.00	1'372.79	3'343.00
Ambul. Costs	705.84	168.19	0.95	489.83	1'283.08
Inpatient costs	545.28	122.07	0.85	334.33	921.89
Elderly care costs	194.64	56.69	0.73	84.35	383.02
Drugs costs	431.78	93.00	0.92	271.30	668.15
Other costs	245.70	62.97	0.92	125.76	444.25
Prop. ambul.	0.33	0.03	0.03	0.27	0.40
Prop. inpatient	0.26	0.03	-0.36	0.20	0.32
Prop. elderly care	0.09	0.02	0.08	0.05	0.14
Prop. drugs	0.20	0.01	-0.15	0.17	0.24
Prop. others	0.12	0.01	0.42	0.08	0.14
Physicians' density	1.80	0.67	0.87	1.01	4.18
Hosp. beds density	5.48	2.30	0.46	2.17	13.48
Hosp. ambul. share	0.33	0.06	0.56	0.21	0.52
Propharmacy	0.29	0.17	-0.75	0.02	0.51
Education	12.77	0.39	0.64	12.00	13.86
Cantonal income	52.92	15.62	0.27	36.44	117.28
Min. deductible	0.46	0.09	-0.70	0.29	0.66
Demographics	0.97	0.06	0.56	0.85	1.14
Time trend	4.00	2.01	0.23	1.00	7.00
Imposition index	3.22	1.74	0.42	0	8.23
Med. school studends	0.80	0.26	0.61	0.37	1.71
Herfindhal	0.13	0.04	-0.37	0.07	0.22
Number insur. comp.	37.58	10.45	0.26	12	64

2.5 Econometric methods

We consider a linear panel data model over the 26 cantons, denoted k, and 7 years, 2001-2007, denoted t. A dependent variable y (health insurance expenditures) is explained

by exogenous explanatory variables X and potentially endogenous explanatory variables Z. Their effect is retrieved via instrumental variables I, through two-stages least squares (2SLS). This approach permits to estimate the model in its reduced form (limited information). I do not specify the structural form of the equation for the potentially endogenous variables. The estimation is done via direct instrumental variables technique (2SLS). For completeness, an OLS regression (not taking into account the endogeneity), a limited information maximum likelihood procedure and a GMM procedure (relying on an orthogonality condition) are presented in the appendix. A 3 stages least squares procedure is less appropriate, as the equation for the instrumented variables are specified only in their limited information (reduced) form. The model is

$$\begin{aligned} y_{kt} &= \beta_X X_{kt} + \beta_Z Z_{kt} + \alpha_k + \epsilon^1_{kt} \\ Z_{kt} &= \gamma_X X_{kt} + \gamma_I I^Z_{kt} + \alpha^Z_k + \epsilon^2_{kt} \end{aligned} \tag{2.1}$$

The panel effect, α_k, can be either a cantonal fixed effect or a random effect[9]. The parameters of interest are β_X and β_Z[10].

Random-effects models are estimated directly via GLS. Fixed-effects models are estimated through a within-transform (see, for instance, Baltagi 2001, chap. 7.2). A fixed-effects estimation induces the estimation of 25 parameters (α_k), in addition to the parameters of interest. Given the low number of observations, in order to control for fixed-effects, while retaining as much explanatory power, the fixed-effects estimations are accounted for by mean-differencing every variable with respect to its cantonal mean, $\bar{V}_k = \frac{1}{t}\sum_t V_{kt}$. The mean-differenced variable is defined as $\tilde{V}_{kt}$.

$$\tilde{V}_{kt} = V_{kt} - \bar{V}_k$$

Computing the mean of y_{kt} leads to the following system

$$\begin{aligned} \bar{y}_k &= \beta_X \bar{X}_k + \beta_Z \bar{Z}_k + \bar{\alpha} + \bar{\epsilon}^1_k \\ \bar{Z}_k &= \gamma_X \bar{X}_k + \gamma_I \bar{I}^Z_k + \bar{\alpha}^Z + \bar{\epsilon}^2_k \end{aligned} \tag{2.2}$$

By construction, $\tilde{\alpha}_k = \alpha_k - \bar{\alpha}_k = 0$. Differentiating the system 2.1 and its averaged counterpart 2.2 leads to

$$\begin{aligned} \tilde{y}_{kt} &= \beta_X \tilde{X}_{kt} + \beta_Z \tilde{Z}_{kt} + \tilde{\epsilon}^1_{kt} \\ \tilde{Z}_{kt} &= \gamma_X \tilde{X}_{kt} + \gamma_I \tilde{I}^Z_{kt} + \tilde{\epsilon}^2_{kt} \end{aligned} \tag{2.3}$$

[9] Time effects (fixed or random) are also possible in theory. However, time will be controlled for in X_{kt}, as a trend, as cantonal effects can only be captured through α_k.

[10] Because only the reduce form model is estimated, the parameters γ_X and γ_Z of the equation for the potentially endogenous variables are not presented.

System 2.3 is the within-transform of the model. Parameters are the same than in model 2.1, and are consistently estimated. The drawback here is that we cannot estimate directly the cantonal fixed effects. However, we are controlling for them. The estimated coefficients are the same as in a standard cantonal fixed-effects model (see Cornwell et al., 1992).

Previous studies on the same kind of topic have used a log-log transform of the models they are estimating. This type of analysis provides an elasticity interpretation to the estimated coefficients, assuming constant elasticity over the dataset. In this work, I estimate a linear form, where coefficients are marginal effects. Given that the focus is on health insurance costs (and not total costs) and their repartition among different type of care, marginal effects appear more relevant than elasticities. Since the results are not qualitatively different, only linear results are displayed.

Health insurance costs, globally and by type of care (ambulatory, stationary, elderly care and drugs), per insured are first measured in levels (y_{kt}). An alternative model examines the repartition of costs across types of care. This approach looks at the dependent variable as a proportion of total health insurance costs (p_{kt}). Explanatory variables will still be considered in levels. As noted by Papke and Wooldridge (1996 and 2008), the study of fractional responses call for a specific econometric setting. Because the dependent variable p_{kt} is bounded between 0 and 1, estimating it linearly would suffer of the same shortcomings than a linear probability model for binary data. A simple solution is to model the true dependent variable p_{kt} (bounded) in the form of log-odds ratio, $G(p_{kt}) = log(\frac{p_{kt}}{1-p_{kt}})$, in a logit transform. Other cumulative functions, such as probit, are also possible. This method assumes $0 < p_{kt} < 1$. It is a reasonable assumption in our empirical setting, as it is very unlikely that a population, on aggregate, experiments no costs associated with a specific type of care at all. Therefore, the fraction of costs will be strictly positive, and smaller than one[11]. The model rewrites

$$\begin{aligned} G(p_{kt}) &= \beta_X X_{kt} + \beta_Z Z_{kt} + \alpha_k + \nu^1_{kt} \\ Z_{kt} &= \gamma_X X_{kt} + \gamma_I I^Z_{kt} + \alpha^Z_k + \epsilon^2_{kt} \end{aligned} \tag{2.4}$$

As in the estimation in levels, the model is estimated in its reduced form via instrumental variables (2SLS). The fixed-effects within estimation proposed above can be adapted here. This method relies on the potentially endogenous variables being continuous, which is satisfied in our setting. Times-constant fixed effects are averaged out, yielding to

$$\begin{aligned} G(p_{kt}) - \frac{1}{t}\sum_t G(p_{kt}) &= \beta_X \tilde{X}_{kt} + \beta_Z \tilde{Z}_{kt} + \tilde{\nu}^1_{kt} \\ \tilde{Z}_{kt} &= \gamma_X \tilde{X}_{kt} + \gamma_I \tilde{I}^Z_{kt} + \tilde{\epsilon}^2_{kt} \end{aligned} \tag{2.5}$$

[11] Mullahy (2010) proposes a method to estimate models where shares may take boundary values with non-trivial probabilities.

It provides consistent estimates of the parameter of interest, β_X and β_Z. If $G(p_{kt})$ is monotonous (as is the case using a logit or probit transform), the sign of the parameters are directly interpretable. The marginal effects of the variables of interest on p_{kt}, however, need to be computed. We will use a logit-transform, as suggested by Papke and Wooldridge (1996). In this case, the marginal effect of X_{kt} on the untransformed variable p_{kt} rewrites (the marginal effect of the variables Z_{kt} are comparable)

$$\begin{aligned}\frac{\partial p}{\partial X} &= \frac{\partial \frac{e^{\hat{\beta}_X \tilde{X}_{kt}+\hat{\beta}_Z \tilde{Z}_{kt}}}{1+e^{\hat{\beta}_X \tilde{X}_{kt}+\hat{\beta}_Z \tilde{Z}_{kt}}}}{\partial X} \\ &= \hat{\beta}_X \frac{e^{\hat{\beta}_X \tilde{X}_{kt}+\hat{\beta}_Z \tilde{Z}_{kt}}}{(1+e^{\hat{\beta}_X \tilde{X}_{kt}+\hat{\beta}_Z \tilde{Z}_{kt}})^2}\end{aligned}$$

2.6 Results

This section discusses the results of the different econometric specifications presented above. The first section deals with the model where costs (including costs by type of care, ambulatory, stationary, elderly care and drugs) are measured in levels, y_{kt}. The second section turns to costs by types of care, as fractions of health costs in the canton, p_{kt}.

2.6.1 Health costs in levels

As already discussed, I take into account the panel dynamic, via fixed effects, and endogeneity, via instrumental variables. Fixed-effects are preferred over random effects. The discrepancy of costs across cantons seems systematic in its mean, and not due to different variances of costs in the different cantons. This finding is confirmed by a Hausman test (in its robust version, as discussed by Wooldridge, 2002). Therefore, only fixed-effects results are presented here.

I consider the total costs paid by health insurances in every canton. I also estimate the same model for ambulatory costs, stationary costs, elderly care costs and drugs costs (as paid by health insurance). Each variable is computed at 2007 prices and by insured individual.

Table 2.2 proposes the results of the 2SLS procedure to take into account the simultaneity problem (computed in a two-steps procedure). Other method, such as OLS (not taking into account a possible endogeneity problem), generalized method of moments (GMM, assuming that the error terms are independent but not necessarily identically distributed), limited-information maximum likelihood (assuming normality of the residuals) are presented in the appendix. The dependent variable is the total costs of health insurance.

Table 2.2: Fixed effects estimations, 2SLS, Total costs

	(1) Total cost
Physicians' density	1168.57***
	(443.54)
Min. deductible	964.87
	(1006.24)
Hosp. beds density	-1.99
	(14.37)
Propharmacy	-1404.88*
	(745.90)
Hosp. ambul. share	1955.95***
	(325.12)
Education	353.27***
	(113.66)
Cantonal income	-5.06*
	(2.87)
Demographics	564.99**
	(251.03)
Time trend	1.93
	(4.00)
Overidentification	4.431

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Estimating the first-stage regressions, the instruments are jointly significant. Table 2.5 also shows the results for overidentification tests (Chi-2 score). This test suggests that instruments perform suitably well, but are close to be weak[12]. However, the Stock and Yogo test suggests that the bias due to weak instruments is lower than the bias due to ignoring the potential endogeneity. As the results are (at least qualitatively) comparable across all specifications, we will consider a 2SLS procedure.

The results of the estimation on total health insurance expenditures show the positive influence of the density of physicians, the proportion of ambulatory costs generated by hospitals, education as well as the demographics composite. At the same time, the propharmacy index and more surprisingly, income have a negative impact, but barely significant. The time trend has no clear impact.

Table 2.3 shows the 2SLS estimations[13] for the costs associated with different types of care, ambulatory care, inpatient care, elderly care, drugs and other types of care for completeness.

[12]This is particularly the case for the estimations of drugs costs and elderly care costs, not presented in table 2.5. See appendix.

[13]Other procedures are shown in the appendix.

Table 2.3: Fixed effects estimations, dependent variable in levels

	(1) Ambul. costs	(2) Inpatient costs	(3) Elderly care costs	(4) Drugs costs	(5) Other costs
Physicians' density	-279.31*	700.77**	125.77	261.12**	415.49***
	(153.19)	(279.35)	(114.09)	(109.54)	(147.19)
Min. deductible	-269.87	9.06	166.37	278.02	600.59*
	(276.51)	(620.06)	(222.70)	(222.08)	(332.20)
Hosp. beds density	6.75	3.49	-1.71	-1.35	-10.38*
	(5.93)	(8.94)	(3.72)	(3.68)	(5.64)
Propharmacy	501.33**	-920.63*	-206.95	-322.29*	-309.33
	(237.23)	(510.21)	(181.31)	(167.76)	(262.68)
Hosp. ambul. share	1015.81***	447.89**	155.53*	42.05	404.11***
	(127.74)	(217.21)	(86.01)	(78.18)	(119.93)
Education	28.00	93.44	91.46***	-10.91	175.03***
	(36.39)	(67.46)	(28.68)	(26.50)	(40.00)
Cantonal income	1.56	-3.36*	-1.75*	-0.53	-1.51
	(1.05)	(1.97)	(0.94)	(0.74)	(0.96)
Demographics	59.84	131.05	-3.20	139.08**	251.38***
	(85.21)	(153.20)	(66.28)	(63.05)	(96.00)
Time trend	4.12***	-4.39*	-1.51	0.89	-2.60**
	(1.21)	(2.45)	(0.93)	(0.95)	(1.29)

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

The last category, other costs, is very heterogeneous, including home care, laboratories... Because of this diversity, caution is required for the interpretation.

The (instrumented) physicians density impacts significantly all types of costs, except elderly care costs. It has a negative impact on ambulatory costs, which induces to think that there is no supply-induced demand on ambulatory care. It impacts positively the other types of costs. This might come from physicians settling where the activity will be important. The hospital beds density has no significant impact, and the estimated coefficients are quantitatively small.

The share of the population choosing the minimum deductible surprisingly is not a significant variable once instrumented, except on other costs.

The propharmacy index impacts positively the ambulatory costs, but negatively the inpatient costs, as well as the drugs costs. Even when it is in the interest of the physician to increase the drugs costs (because he is dispensing them), there seem to be no supplier induced demand. The increase in ambulatory costs, on the other hand, might come from the increase in consultations rate due to the necessity to see a physician if they are delivering directly the drugs, as there might be a lower pharmacies density.

The share of ambulatory costs generated by the hospitals impacts positively the ambulatory costs, either because the hospital have higher fixed costs than physicians to treat the same diseases, or because they use to treat more expensive ambulatory diseases than the physicians. It also impacts positively the inpatient costs, as there seem to be no economies of scale for hospitals of having a large ambulatory activity. The impact on elderly care is more surprising, but barely significant. As some hospitals also have a small elderly care component, there might be some spillover effects

Surprisingly, education has no significant impact except on elderly care costs (positively), while it had an important impact on total costs. Its impact is positive on other costs.

Income, who has a surprising negative effect on total costs, has no effect on ambulatory costs or drugs costs. These types of care are probably the ones where individual decision is the more important. There is no reason for a richer individual to get more inpatient or elderly home care, where I find a negative significant effect of income.

The index for demographics, has few effects, except on drugs costs. Time trend is positive for ambulatory costs, but negative for inpatient costs and other costs, where there is an important incentive for governments to control them.

An important issue raised in the international literature on aggregated health costs has been stationarity. If the explained variable is not stationary, estimates are not reliable. Given the comparatively low number of years we consider, it is probably not a problem in our setting. This conclusion is confirmed by the Levin-Lin-Chu (2002) test. With a trend, included in every estimation presented here, no variable shows any problem of stationarity.

2.6.2 Proportions of costs

In this section, I examine models of health costs in proportions. Still controlling for endogeneity, I only consider fixed-effects. Again, it seems reasonable to assume that the cantonal differences are systematic in their mean, and not only in their variance. Examining the costs by type of care as proportions of the total costs permits to compare costs between cantons, standardizing by total costs rather than by insured. Table 2.4 presents the results of the fixed effects 2SLS estimations (other estimations are presented in the appendix).

Table 2.4: Fixed effects estimations, dependent variable in proportions

	(1) Prop. outpatient	(2) Prop. inpatient	(3) Prop. elderly care	(4) Prop. drugs	(5) Prop. others
Physicians' density	-1.49***	1.43**	0.28	-0.04	0.91*
	(0.49)	(0.56)	(0.61)	(0.24)	(0.48)
Min. deductible	-0.83	-0.02	0.89	0.18	0.59
	(1.03)	(1.21)	(1.18)	(0.54)	(1.04)
Hosp. beds density	0.01	0.01	-0.01	-0.00	-0.04***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Propharmacy	1.93**	-1.60	-1.06	-0.06	-0.26
	(0.81)	(0.99)	(1.02)	(0.42)	(0.86)
Hosp. ambul. share	0.76**	-0.06	0.01	-1.12***	0.50
	(0.36)	(0.41)	(0.46)	(0.17)	(0.34)
Education	-0.19*	-0.01	0.27*	-0.28***	0.54***
	(0.10)	(0.13)	(0.15)	(0.06)	(0.12)
Cantonal income	0.01**	-0.01**	-0.01	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Demographics	-0.15	0.10	-0.53*	0.02	0.48
	(0.25)	(0.29)	(0.31)	(0.14)	(0.30)
Time trend	0.01**	-0.02***	-0.00	0.01**	-0.01
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Physician's density has the same kind of impact than in levels. It influences positively the share of inpatients costs and negatively the share of ambulatory costs. It has no effect on the share of drugs costs, even though it has an effect in levels. It also impacts positively the share of other costs. These are impacted negatively by the density of hospital beds.

The effect of the proportion of insured choosing the minimum deductible is also coherent with the estimation in levels.

The propharmacy index also exhibits the same behavior than in levels. It is however interesting to note that its effect on the share of costs devoted to drugs is not significant any more.

The share of ambulatory costs generated by hospitals again increases the share of ambulatory costs in total costs. It has however no longer an effect on the share of inpatient costs, while it increased it in levels, and decreases significantly the share of drugs costs.

Education has a different effect here than in levels. It now impacts negatively the share of ambulatory and drugs costs. It also impacts positively the share of elderly care costs and other costs.

Income has also an interesting impact. It impacts positively the share of ambulatory costs and again negatively the share of inpatient costs. Again, it as no effects on drugs costs.

Demographics structure has a negative effect on elderly care share of costs (it is not significant in levels), and no more effect on drugs share of costs.

The time trend, as previously, has a positive impact on ambulatory sharer of costs, but also on drugs share of costs (not significant in levels) and a negative impact on inpatient share of costs.

The estimations of the costs in levels and in share of the total costs exhibit the same pattern. A few differences, essentially on demand variables, details the repartition of health expenditures, rather than in the level of expenditures. Notably, the impact of income on the ambulatory share of costs is positive, for a type of care where socio-economic status can be an important determinant of demand. The time trend having the same kind of impact is not surprising.

2.7 Conclusion

This chapter discussed the determinants of health insurance expenditures in Switzerland. These are not total health costs as the compulsory health insurance costs represent 35% of total costs. However, at the national level, total costs and health insurance expenditures are very highly correlated. The costs financed through other sources are either not available, or not comparable across cantons. In a panel data framework, taking into account potential endogeneity of the physicians density and the deductible choice, the model is estimated in levels, separately for total costs and by type of care (ambulatory, inpatient,

elderly care and drugs costs), and in proportions of the type of care with respect to the total costs. The preferred specification implies cantonal fixed effects and a two-stages least square limited information procedure.

The results show an important effect of physicians density, propharmacy behavior (physicians dispensing drugs directly), the importance of ambulatory care in the hospital, education, income, and time trend.

The physicians density increases the costs. However, its impact is negative on ambulatory costs, that we could expect is more directly impacted by the physicians themselves. There seem to be no effect of physicians discretionary power on care consumption. But it is probably the case that physicians settle where care is more intensive (close to hospitals, high proportion of elderly...), or because physicians can also, in some cases, work part time in a free practice setting, and part time in the hospital. It could also be the case that competition between physicians is thus fiercer in these cantons, reducing the costs. Another explanation could be that, in some cantons where the density of physicians is low, the hospital will provide, at high cost, the ambulatory services the physicians cannot ensure. This would also lead to a result where a high density of physicians is associated with lower ambulatory costs. Physicians density also impacts in an important way the share of other costs, that are mostly ambulatory (physiotherapy, home care, laboratory...) It could be the case that physicians gain a non negligible part of their income through these other types of ambulatory care, and therefore could reduce their costs directly linked to medical consultations.

The propharmacy behavior (dispensing physicians) impacts negatively the costs, particularly inpatient care. It however increases the ambulatory costs. Drug dispensing physicians do not seem to prescribe more drugs. However, it is likely that they increase their fees by being the main contact of the patient with the health system, as pharmacies are scarce. As costs are typically lower in cantons where the propharmacy behavior is usual, this interpretation is confirmed by the absence of effect of this variable on the drugs related share of total costs.

The repartition of ambulatory care between hospitals and free practice physicians is the last important supply variable. It impacts positively the total costs and the ambulatory costs (in levels and in proportion). Either the hospital is not as efficient in providing ambulatory care, or, more likely, it provides ambulatory treatments for more expensive diseases. There seem to be no positive spillover, however, on the stationary costs in levels. It is interesting to note that the share of costs devoted to inpatient care is not affected. When hospitals have an important ambulatory activity, they also have an important inpatient activity in levels, but not as a share of costs. Hospitals outpatient activity impacts total costs, rather than only hospital costs.

Education has an important impact on total costs. However, its only significantly positive effect is on elderly care. This probably reflects a life expectancy effect, as higher educated individuals tend to live longer.

Income has a significant (at a 10% level) negative effect. This is surprising when compared to the existing literature. But given the small period of time considered, and the somewhat small differences between Swiss cantons (smaller than between countries), this positive effect could be a health status effect. The type of care more sensitive to a consumerist behavior, ambulatory care, is positively influenced by income (in proportions, but is not significant in levels). We observe however no significant effect of income on the other type costs that sould be impacted by consumerists behavior, drugs costs. A possible explanation for this absence of effect can be that health insurance reimburses only prescribed drugs. There is then a filter before drugs consumption. There is no reason to think that richer individuals are willing to engage in heavy treatments, such as inpatient care, and we observe income impacting these types of expenditures negatively. It is probably also the case that income is linked to deductible choice. A low income might force the choice of a high deductible, in order to limit the health insurance premia. In such cases, where deductible choice is only in a limited way linked to health status, a low income is associated with higher health insurance costs.

It is possible that this surprising impact of income is partially due to the limitation of this study on health insurance expenditures. The public good part of the health costs (government subsidies) are not included in my measure of costs. Reich et al., 2010, include the government subsidies, and find a negative significant effect for income in Switzerland. The out-of-pocket expenditures, that should be under control of the individuals, and therefore directly impacted by its income, are also not included in my analysis. Crivelli et al., 2006, include both the subsidies and a measure of out-of-pocket expenditures, and the effect they find is also negative, but not significant.

Time trend has a mixed effect. It is positive for ambulatory care, but negative for inpatient care (both in levels and in proportions). But the time period is relatively short. Inpatient care costs are particularly controlled by the authorities, particularly in cantons where they are important. The negative effect of time is not surprising. In some studies, time trend has been interpreted as technological progress. But again because of the short period, there are probably too few progress for the trend to act as a proxy. In a recent paper, Lamiraud and Lhuillery (unpublished) have measured more precisely the effect of different technologies, and find a positive impact.

The pricing of the different component of the health care costs are usually regulated. On ambulatory care, prices are set at the cantonal level. Each medical act is worth a given number of points, defined nationally. Each canton then defines the price of each point. Therefore, changes in insurance costs do not necessarily reflect only a change in quantity. As the prices are known *ex ante*, some distortions can appear. For instance, these prices could in part depend on the income level of the canton, and therefore influence costs (outside of the effect of income on utilization). Inpatient care pricing follows a close method. Prices are based on historical data but corrections can take place *ex post* to finance all stays provided. Given the nature of inpatient costs, it is unlikely that prices affect utilization. Therefore, prices probably don't impact the estimations presented here.

Elderly care pricing vary wildly from one canton to another. Their effects on the estimation are probably mild, as this analysis focuses on care costs, which is only a fraction of the cost that is ultimately paid (the other part concerning accommodation costs). On the other hand, drugs prices are fixed in the whole country, so the effect of drugs prices on costs should be limited. However, the use of different types of drugs with different prices for the same effect, for instance the use of generics, or the switch to another form of therapy, could also generate some distortions. Again, there are interactions with the other types of financing mechanisms, particularly out-of-pocket payments. Prices probably impact more importantly out-of-pocket expenditures, because of the consumer optimization behavior.

This study suffer from some shortcomings. I only consider compulsory health insurance costs. The advantage of using only health insurance costs are an improved comparability between cantons, and the possibility of studying separately the different types of care. Health insurance is also the most visible part of the health care costs. This comes at the cost of explaining only a fraction of total costs. The results found by Crivelli et al. (2006, using random effects estimation) and Reich et al. (2010), using also public subsidies and cost sharing are comparable. However, even with the very high correlation observed between total costs and insurance costs, generalizing the results exposed here to the global costs of health care in Switzerland calls for caution, particularly on the repartition of costs between types of care. The different types of care are not financed in the same ways.

Data availability, as well as the relevance of health insurance issues in the political debate justifies the limitation to health insurance expenditures. However, this is an important limitation of this study, as most of the international literature has been focusing on total health care costs. Comparability with other studies is limited.

The smallness of the database is also a problem. Due to data availability, it was restricted to 2001-2007. By dropping a few variable, it could have been extended to 1998-2007. However, these variables (among others education) seemed important for the analysis.

Medical practice seem also to be an important determinant of costs. It was here only captured through the propharmacy behavior. Other variables describing practice (such as differences in what is provided during an ambulatory consultation) would have been interesting. As discussed earlier, a measure of technological progress seems important. The measure of demographics that I use does not seem to have an important impact. A more detailed measure, only possible by using more data, would be interesting.

Finally, the analysis has been conducted on aggregated data. The conclusions are thus not relevant on an individual level.

At the cantonal level, the important factors seem to be the organization of ambulatory care (share provided by hospitals, density of physicians, physicians dispensing behavior), particularly since the measure of hospital beds density has so little impact. The other important determinants of health insurance expenditures are demand variable, income and education. These cannot really be influenced by the regulator. At the same time, the costs seem to be, globally, under control, as the time trend has no significant impact.

A large effort has been undertaken in Switzerland in recent years to contain inpatient costs. These seem to be under control, as the time trend is not a significant variable in the estimation on inpatient costs. Few variables that have a significant impact on these costs are under the regulator's control. Still, the health insurance expenditures are very high, and therefore so are premia. The governments, at a federal and cantonal level, are under high pressure to alleviate these costs. The attention of the regulator should probably be focused on ambulatory costs. In ambulatory care providing, the organization of care is the important factor. In particular, if the hospitals have to provide ambulatory care, it leads to higher costs. This work remained at the insurance costs level, but a more detailed analysis of ambulatory care (content and length of consultations, medical practice...) might reveal other possibilities for politicians to influence the health insurance costs. Another area for political intervention could be on drugs costs. Prices for a substance can vary in an important way, through the use of generics for instance. Quantity taken seem also to vary across cantons. Public intervention in this area could also be fruitful, but would require further analytical studies.

2.8 Appendix

Appendix

Table 2.5: Fixed effects estimations, Total costs

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	332.66***	1168.57***	1213.56***	1836.27
	(107.97)	(443.54)	(442.38)	(1244.73)
Min. deductible	266.22	964.87	851.52	2141.28
	(250.36)	(1006.24)	(992.37)	(2621.55)
Hosp. beds density	6.30	-1.99	3.58	-10.37
	(10.06)	(14.37)	(13.84)	(28.64)
Propharmacy	-717.49	-1404.88*	-1315.68*	-2280.92
	(482.94)	(745.90)	(739.96)	(1864.20)
Hosp. ambul. share	1996.55***	1955.95***	1989.35***	2045.64***
	(269.53)	(325.12)	(323.84)	(526.78)
Education	388.48***	353.27***	344.62***	400.68**
	(67.15)	(113.66)	(109.87)	(187.95)
Cantonal income	0.08	-5.06*	-5.64**	-8.72
	(1.16)	(2.87)	(2.86)	(6.85)
Demographics	694.77***	564.99**	511.89**	567.47
	(181.28)	(251.03)	(242.93)	(357.16)
Time trend	7.50***	1.93	2.01	-3.93
	(1.19)	(4.00)	(4.00)	(11.45)
Overidentification		4.431	4.431	4.451

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.6: Fixed effects estimations, Ambulatory costs, in levels

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	-14.10	-279.31*	-253.46*	-345.00
	(32.94)	(153.19)	(141.72)	(212.50)
Min. deductible	28.15	-269.87	-268.98	-385.70
	(67.77)	(276.51)	(264.63)	(391.40)
Hosp. beds density	3.90	6.75	6.76	7.57
	(2.87)	(5.93)	(5.64)	(7.07)
Propharmacy	242.86*	501.33**	481.30**	587.56*
	(126.85)	(237.23)	(225.25)	(318.13)
Hosp. ambul. share	1018.01***	1015.81***	1004.70***	1006.96***
	(89.20)	(127.74)	(124.07)	(145.75)
Education	26.16	28.00	23.90	23.33
	(19.19)	(36.39)	(35.29)	(42.77)
Cantonal income	-0.01	1.56	1.43	1.92
	(0.41)	(1.05)	(0.99)	(1.34)
Demographics	31.78	59.84	56.99	59.58
	(54.65)	(85.21)	(82.77)	(97.11)
Time trend	2.18***	4.12***	4.01***	4.70***
	(0.33)	(1.21)	(1.14)	(1.75)
Overidentification		1.861	1.861	1.962

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.7: Fixed effects estimations, Inpatient costs, in levels

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	175.29**	700.77**	716.78**	869.76*
	(69.60)	(279.35)	(278.62)	(456.24)
Min. deductible	175.76	9.06	-55.29	213.59
	(187.76)	(620.06)	(617.60)	(980.07)
Hosp. beds density	6.98	3.49	6.38	1.63
	(6.64)	(8.94)	(8.60)	(11.67)
Propharmacy	-808.91**	-920.63*	-715.63	-1093.07
	(367.07)	(510.21)	(484.57)	(742.94)
Hosp. ambul. share	593.08***	447.89**	438.13**	452.18*
	(203.22)	(217.21)	(216.27)	(250.82)
Education	189.60***	93.44	89.42	94.05
	(46.25)	(67.46)	(66.95)	(81.02)
Cantonal income	0.31	-3.36*	-3.38*	-4.35
	(0.91)	(1.97)	(1.94)	(2.76)
Demographics	316.65**	131.05	127.90	115.67
	(128.41)	(153.20)	(153.88)	(169.74)
Time trend	-2.28***	-4.39*	-4.28*	-5.66
	(0.86)	(2.45)	(2.46)	(4.13)
Overidentification		2.557	2.557	3.080

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.8: Fixed effects estimations, Elderly care costs, in levels

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	16.62	125.77	120.03	223.99
	(24.50)	(114.09)	(114.38)	(233.06)
Min. deductible	-143.36***	166.37	165.17	376.06
	(54.28)	(222.70)	(224.84)	(458.65)
Hosp. beds density	-0.01	-1.71	-0.34	-3.05
	(2.77)	(3.72)	(3.61)	(5.84)
Propharmacy	-1.65	-206.95	-218.66	-355.19
	(110.97)	(181.31)	(179.46)	(343.26)
Hosp. ambul. share	117.68*	155.53*	150.19*	175.96
	(66.31)	(86.01)	(83.62)	(115.78)
Education	69.36***	91.46***	87.51***	102.91***
	(18.70)	(28.68)	(28.32)	(39.79)
Cantonal income	-1.24**	-1.75*	-1.79*	-2.27
	(0.58)	(0.94)	(0.94)	(1.51)
Demographics	-23.77	-3.20	-3.77	3.45
	(50.60)	(66.28)	(67.70)	(82.45)
Time trend	-0.28	-1.51	-1.47	-2.45
	(0.32)	(0.93)	(0.94)	(2.01)
Overidentification		3.874	3.874	3.861

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.9: Fixed effects estimations, Drugs costs, in levels

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	99.96***	261.12**	273.36**	472.25
	(24.23)	(109.54)	(110.38)	(413.31)
Min. deductible	-17.39	278.02	250.34	695.84
	(51.09)	(222.08)	(223.31)	(835.24)
Hosp. beds density	0.70	-1.35	-0.47	-4.13
	(1.87)	(3.68)	(3.73)	(8.35)
Propharmacy	-104.79	-322.29*	-325.22*	-623.53
	(99.36)	(167.76)	(169.51)	(588.90)
Hosp. ambul. share	18.13	42.05	33.25	79.46
	(63.94)	(78.18)	(78.09)	(150.36)
Education	-23.75	-10.91	-16.84	9.68
	(16.63)	(26.50)	(26.33)	(55.94)
Cantonal income	0.35	-0.53	-0.60	-1.65
	(0.41)	(0.74)	(0.73)	(2.23)
Demographics	136.51***	139.08**	148.00**	147.73
	(42.19)	(63.05)	(62.22)	(103.06)
Time trend	2.33***	0.89	0.90	-1.07
	(0.32)	(0.95)	(0.96)	(3.77)
Overidentification		6.528	6.528	5.093

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.10: Fixed effects estimations, Ambulatory costs, in proportions

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	-0.27***	-1.49***	-1.49***	-1.50***
	(0.09)	(0.49)	(0.48)	(0.50)
Min. deductible	0.02	-0.83	-0.83	-0.85
	(0.17)	(1.03)	(1.02)	(1.04)
Hosp. beds density	0.00	0.01	0.01	0.01
	(0.01)	(0.02)	(0.02)	(0.02)
Propharmacy	1.02***	1.93**	1.95**	1.95**
	(0.27)	(0.81)	(0.80)	(0.82)
Hosp. ambul. share	0.67***	0.76**	0.78**	0.76**
	(0.21)	(0.36)	(0.36)	(0.37)
Education	-0.27***	-0.19*	-0.20**	-0.20*
	(0.04)	(0.10)	(0.10)	(0.10)
Cantonal income	0.00	0.01**	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Demographics	-0.37***	-0.15	-0.16	-0.15
	(0.14)	(0.25)	(0.25)	(0.26)
Time trend	0.00***	0.01**	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Overidentification		0.113	0.113	0.115

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.11: Fixed effects estimations, Inpatient costs, in proportions

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	0.23*	1.43**	1.52***	1.83*
	(0.13)	(0.56)	(0.57)	(0.94)
Min. deductible	0.14	-0.02	-0.05	0.49
	(0.32)	(1.21)	(1.24)	(1.98)
Hosp. beds density	0.02	0.01	0.01	0.00
	(0.01)	(0.02)	(0.02)	(0.02)
Propharmacy	-1.22*	-1.60	-1.41	-2.02
	(0.62)	(0.99)	(0.98)	(1.51)
Hosp. ambul. share	0.23	-0.06	-0.10	-0.04
	(0.38)	(0.41)	(0.41)	(0.49)
Education	0.18**	-0.01	-0.01	-0.01
	(0.08)	(0.13)	(0.13)	(0.15)
Cantonal income	0.00	-0.01**	-0.01**	-0.01*
	(0.00)	(0.00)	(0.00)	(0.01)
Demographics	0.49**	0.10	0.11	0.07
	(0.23)	(0.29)	(0.30)	(0.33)
Time trend	-0.01***	-0.02***	-0.02***	-0.02**
	(0.00)	(0.00)	(0.01)	(0.01)
Overidentification		3.389	3.389	3.007

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.12: Fixed effects estimations, Elderly care costs, in proportions

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	-0.10	0.28	0.22	0.63
	(0.12)	(0.61)	(0.60)	(1.07)
Min. deductible	-0.89***	0.89	0.65	1.72
	(0.32)	(1.18)	(1.16)	(2.07)
Hosp. beds density	-0.00	-0.01	-0.00	-0.01
	(0.01)	(0.02)	(0.02)	(0.03)
Propharmacy	0.02	-1.06	-0.94	-1.63
	(0.60)	(1.02)	(0.99)	(1.62)
Hosp. ambul. share	-0.26	0.01	-0.10	0.10
	(0.35)	(0.46)	(0.45)	(0.57)
Education	0.10	0.27*	0.22	0.32
	(0.09)	(0.15)	(0.15)	(0.20)
Cantonal income	-0.00*	-0.01	-0.01	-0.01
	(0.00)	(0.00)	(0.00)	(0.01)
Demographics	-0.72***	-0.53*	-0.59*	-0.49
	(0.26)	(0.31)	(0.31)	(0.37)
Time trend	0.00*	-0.00	-0.00	-0.01
	(0.00)	(0.01)	(0.01)	(0.01)
Overidentification		3.892	3.892	3.393

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.13: Fixed effects estimations, Drugs costs, in proportions

	(1) OLS	(2) 2SLS	(3) GMM	(4) LIML
Physicians' density	0.13*	-0.04	0.03	-3.57
	(0.07)	(0.24)	(0.24)	(89.59)
Min. deductible	0.02	0.18	0.21	-6.72
	(0.16)	(0.54)	(0.54)	(179.56)
Hosp. beds density	-0.00	-0.00	-0.00	0.04
	(0.01)	(0.01)	(0.01)	(1.20)
Propharmacy	-0.04	-0.06	-0.39	4.93
	(0.30)	(0.42)	(0.42)	(128.97)
Hosp. ambul. share	-1.19***	-1.12***	-1.11***	-1.73
	(0.16)	(0.17)	(0.17)	(16.42)
Education	-0.32***	-0.28***	-0.26***	-0.61
	(0.04)	(0.06)	(0.05)	(8.97)
Cantonal income	0.00	0.00	0.00	0.02
	(0.00)	(0.00)	(0.00)	(0.47)
Demographics	-0.06	0.02	0.02	-0.11
	(0.12)	(0.14)	(0.14)	(3.98)
Time trend	0.00***	0.01**	0.00**	0.04
	(0.00)	(0.00)	(0.00)	(0.84)
Overidentification		9.889	9.889	8.888

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.14: Random effects estimations, dependent variable in levels

	(1) Total cost	(2) Ambul. costs	(3) Inpatient costs	(4) Elderly care costs	(5) Drugs costs	(6) Other costs
Physicians' density	199.545	261.885***	-98.175	67.873	43.851	23.498
	(202.705)	(75.159)	(101.384)	(62.594)	(49.905)	(27.431)
Min. deductible	-620.428	113.283	-778.305**	-10.413	99.217	21.035
	(501.855)	(173.777)	(322.321)	(138.690)	(102.493)	(92.920)
Hosp. beds density	17.134	-7.162	25.869***	0.442	-1.054	-5.386**
	(14.969)	(5.184)	(9.093)	(4.126)	(3.020)	(2.552)
Propharmacy	-279.891*	45.761	-61.659	-31.501	-145.147***	-43.489*
	(166.321)	(61.351)	(86.429)	(50.933)	(40.293)	(23.716)
Hosp. ambul. share	1345.350***	1113.234***	47.046	27.797	-1.064	66.697
	(326.300)	(110.171)	(239.546)	(86.769)	(62.877)	(72.097)
Unemployment rate	1393.083	187.431	354.730	67.231	445.385*	237.667
	(1212.467)	(419.740)	(820.224)	(335.620)	(249.456)	(243.423)
Invalidity pensions	236.646	-2407.696***	1535.624	-231.405	1107.704***	394.474
	(1770.611)	(614.103)	(1157.969)	(491.066)	(364.329)	(336.840)
Urban pop. share	146.942	55.475	78.278	-40.815	9.585	8.027
	(119.859)	(45.104)	(63.229)	(38.200)	(31.781)	(17.612)
Education	73.715	0.117	-24.230	36.276	-5.945	27.662
	(168.947)	(59.077)	(102.935)	(47.309)	(34.947)	(29.314)
Cantonal income	-0.617	-1.510**	1.661	-1.635***	0.182	-0.029
	(1.755)	(0.627)	(1.031)	(0.511)	(0.391)	(0.293)
Demographics	176.042	-80.161	134.816	-129.755*	100.521*	165.121**
	(292.238)	(97.483)	(226.378)	(76.202)	(54.495)	(69.509)
Time trend	33.012***	-3.242	15.780***	4.396**	4.309***	12.974***
	(7.021)	(2.433)	(4.567)	(1.943)	(1.437)	(1.335)
Constant	170.246	107.125	777.820	-169.170	242.406	-425.274
	(2136.898)	(738.809)	(1379.749)	(588.087)	(430.599)	(400.376)

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 2.15: Random effects estimations, dependent variable in proportions

	(1) Prop. outpatient	(2) Prop. inpatient	(3) Prop. elderly care	(4) Prop. drugs	(5) Prop. others
Physicians' density	-1.134**	0.956	1.178	-0.435	0.545
	(0.512)	(0.653)	(0.908)	(0.305)	(0.508)
Min. deductible	-1.040	-0.133	1.408	-0.173	1.530*
	(0.837)	(1.071)	(1.495)	(0.502)	(0.835)
Hosp. beds density	0.012	0.014	-0.023	0.000	-0.040**
	(0.015)	(0.020)	(0.028)	(0.009)	(0.015)
Propharmacy	2.239**	-1.666	-2.395	0.444	-0.649
	(0.914)	(1.173)	(1.653)	(0.555)	(0.922)
Hosp. ambul. share	1.286***	-0.123	-0.670	-0.926***	-0.439
	(0.346)	(0.442)	(0.619)	(0.208)	(0.346)
Unemployment rate	2.457	-0.932	-1.100	1.216	-4.616***
	(1.644)	(2.102)	(2.929)	(0.983)	(1.638)
Invalidity pensions	-3.294	-1.657	-3.182	3.289**	7.889***
	(2.283)	(2.921)	(4.081)	(1.370)	(2.280)
Urban pop. share	-6.804	-0.711	12.811	-5.108	14.607**
	(5.752)	(7.390)	(10.459)	(3.516)	(5.827)
Education	-0.296	0.068	0.403	-0.126	0.279
	(0.185)	(0.239)	(0.345)	(0.116)	(0.191)
Cantonal income	0.005**	-0.004	-0.011**	0.003**	-0.001
	(0.003)	(0.003)	(0.005)	(0.002)	(0.003)
Demographics	0.063	-0.030	-0.995**	0.234	0.273
	(0.263)	(0.337)	(0.471)	(0.158)	(0.263)
Time trend	-0.003	-0.011	-0.014	-0.001	0.041***
	(0.014)	(0.017)	(0.025)	(0.008)	(0.014)
Constant	-0.573***	-1.038***	-2.291***	-1.322***	-2.478***
	(0.082)	(0.106)	(0.151)	(0.051)	(0.084)

Standard error in parenthesis. *** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Chapter 3

Strategic pricing behaviors in the presence of consumer inertia: the case of health insurance

In collaboration with Karine Lamiraud

3.1 Introduction

Some nations have implemented competition in health insurance markets. Competition is assumed to put insurance providers under consumer pressure, and to generate incentives to increase quality and/or decrease premiums. However, as for any market, competition works only if enough consumers switch to more efficient insurers.

Inertia and low switching rates have been emphasized in the literature investigating consumer behavior in health insurance markets (Strombom et al., 2002, Frank and Lamiraud, 2009). In the Netherlands, Lako et al. (2010) emphasized that Dutch insured do not switch health plans following individual reflections, but rather abandon their choice of insurance to organizations purchasing group contracts. They confirm the low switching rates already discussed for the Netherlands (see for instance De Jong et al. 2008). In Israel, the conclusion is the same (Schmueli et al. 2007). In the US, Cunningham and Kohn (2000) argue that only one-fourth of the switching between health plans is voluntary, the majority coming from job change, or change of employer plan offering. Several studies in different countries estimated very low price elasticities of demand in health insurance

markets. Schut and Hassink (2002) and Schut et al. (2003) found a low elasticity for the Netherlands, Tamm et al. 2007 found the same for Germany. Switching is very low in these countries, and the efficiency of the managed competition systems is questioned (Hendriks et al. 2009).

Knowing about this inertia, firms should respond optimally and take advantage of it. We examine firms' pricing strategies in settings where competitive health insurance companies offer both basic and supplementary insurance products. In particular, we look at the possibility for firms to price some of their products at a low level. In this setting, the product sold at a low price can be due to specialization of the firm in the production of this good, or can generate a loss or a lower margin (loss-leader pricing). But, this marketing tool permits firms to attract more consumers, and sell them other products that produce a high margin. Strategic pricing behavior, such as loss-leader pricing, can generate higher profit for these multi-products firms (Lal and Matutes 1994).

Our analysis focuses on the Swiss setting as it provides an interesting case. In Switzerland, the same insurance companies offer basic (compulsory) and supplementary insurance products, thus being active on these two competitive markets. Offering several products may allow them to tie the conditions of these various insurance products and for example to implement such a low price product strategy.

Section 2 discusses the background of our study. Section 3 presents the data and methods, while section 4 deals with the results. Section 5 discusses these results.

3.2 Background

3.2.1 Multiple products pricing

Links between the pricing of different products can take different forms. The industrial economics literature lists, among other strategies, bundling (tying) and loss-leader pricing.

Bundling is the sale of two or more products in a package (Stremersch and Tellis, 2002). It can be more profitable than even monopoly pricing (Adams and Yellen 1976, Whinston 1990). But, for the consumer to be willing to buy the bundle, it must come at a discount with respect to the goods sold separately (Matutes and Regibeau 1992). It is unclear which of the products is generating profits for the firm.

Empirically Stahl et al. (2004) test the bundling of information goods by newspapers websites. They show that rebundling (under the form of dossiers typically) is more profitable than single article selling. Evans and Salinger (2004) analyze over-the-counter pain relievers and cold medicines as bundling of several drugs. They exploit differences in pricing for different package sizes. They find a substantial bundle discount.

Another possibility is that firms price some of their products at a low price, while making an important profit on another good. This strategy can take the form of add-on pricing.

In these cases, one product is sold at a low price (for instance, a hotel room), while another, not necessary for the use of the first god is sold at a premium (the minibar). This strategy permits price discrimination between consumers ready to pay a high price for the additional utility of the add-on, and increase profits (Armstrong and Vickers 2001, Ellison 2005) Another pricing strategy where one product is priced at a low cost, and another at a high cost is "loss-leaders" or "low-margin leaders". These are products priced at a low level (they can still generate profits) and which are heavily marketed (Holton 1957, Simbanegavi 2008). They provide incentives for customers to shop in a particular store (Salop and Stiglitz 1977, Varian 1980). Once at the store, consumers buy goods other than the loss-leaders (Hosken and Reiffen 2007, Beard and Stern 2008). Hence, loss-leaders increase profits through the sale of other products (Lal and Matutes 1994).

Empirically, the pricing strategy consisting of one expensive and one cheap product is typically tested indirectly and not directly from observed prices. One approach consists in comparing the profit for each product. Wang (2009) finds that large supermarket chains offering gasoline at a discount on their site typically have a loss-leader pricing strategy on this product. Chevalier et al. (2003) show that supermarkets have a tendency to price goods which consumers look for more at a lower margin, particularly in periods of important demand. Lee and Png (2004) find that bestsellers in book stores are typically loss-leaders. De Graba (2003), based on the results of his model, suggests measuring the profit. When choosing a loss-leader good, it should be purchased by more profitable consumers He also suggests examining the size of the basket of goods bought very closely. If there is a loss-leader in the basket, its size should be considerably larger than a basket not containing that loss-leader.

3.2.2 Swiss health insurance markets

Switzerland is divided into 26 cantons, with each canton responsible for the organization of its own health care system. The overall health care system is regulated by the Federal Law on Social Health Insurance (LAMal).

The LAMal, which was adopted in 1996, aimed at introducing a managed competition scheme for basic health insurance. The main regulatory features of the Swiss basic health insurance system are as follows: 1) Basic health insurance is mandatory; 2) A standardized basic benefit package and the level of cost sharing (deductible, coinsurance of 10% up to an annual ceiling) are both defined by law and are invariant across insurers; 3) Premiums are community-rated, that is to say, premiums can differ between health plans but an insurer must offer uniform premiums for people in the same age groups (0-18, 19-25, and >25), in the same geographic area (78 regions, i.e. 3 per Canton), with the same type of coverage (i.e. contracts with low/high deductible levels and/or contracts with a limited choice of providers); 4) Health insurers must accept every applicant. There is an

open enrolment opportunity every six months (June and December) in which individuals can switch insurance providers. The actual switching procedure is simple: the individual must write a letter to their health insurer; 5) A risk adjustment mechanism is in place to avoid risk selection. Furthermore, clear-cut regulatory separation exists between basic statutory coverage and optional supplementary insurance. Consumers can purchase basic and supplementary insurance from two different providers. Supplementary insurance is not regulated by LAMal but by Insurance Contract Law (LCA). In the supplementary insurance market, insurers may refuse bad risks and offer risk-rated premiums.

In a health insurance market with community-rated premiums for each health plan, homogeneous benefits, open enrollment and low switching costs, one might expect that individuals would migrate toward the basic insurance plans offering the lowest premiums, and thus premium differences across insurance plans would be very small. However, substantial differences in premiums for compulsory health insurance have remained within each canton since 1996. This can be accounted for by little consumer switching rates between basic plans (between 3% and 5% per year). Another aspect of consumer inertia has been highlighted in relationship with the choice of insurance providers: most enrollees subscribe to supplementary insurance using the same insurer who provides their basic contract (93% in 2001, 91% in 2007).

Previous research has been carried out from the consumer point of view in explaining these puzzles. Several factors may explain why consumers do not switch in basic insurance. Frank and Lamiraud (2009) provide evidence of consumer inertia associated with status quo bias and choice overload and highlight that consumers sometimes make errors in choosing health plans. Dormont et al. (2009) identify supplementary insurance as a factor that can partly explain the reasons why enrollees are reluctant to switch in basic insurance. They identify possible mechanisms through which supplementary insurance may affect the decision to switch in basic insurance markets under the assumption that consumers take out basic and supplementary insurance with the same provider. The empirical findings suggest that the main mechanisms at work rely on customer beliefs regarding selection practices in supplementary markets: if the customer thinks he/she is a "bad" risk and believes that insurers reject applications for supplementary contracts from individuals considered as such, he/she might refrain from switching, even for basic insurance. They show that, for those having supplementary insurance, the likelihood of switching decreases when subjective health status deteriorates. Furthermore, it has been highlighted that subscribing basic and supplementary contracts with two different insurers may induce some administrative costs for the subscriber, such as sending separate bills, etc (Colombo, 2001; Dormont et al, 2009).

In this chapter, we examine firms' pricing strategies. Knowing about consumer inertia, firms should respond and take optimal advantage of it. In particular, the fact that most individuals take out basic and supplementary coverage with the same provider may also suggest that basic and supplementary markets are linked together and that insurers manage to tie the conditions of basic and supplementary contracts.

Studies on the pricing of health insurance in Switzerland are sparse. Kifmann (2003) examines the connections between basic and supplementary insurance, looking at a model where compulsory insurance is sold at a uniform premium, but where high risk applicants must pay a markup when purchasing supplementary insurance, while low risks get a discount. Competition between insurers is based on this markup. Due to the existence of "administrative costs", he finds that it is more efficient for the clients to buy basic and supplementary insurance from the same provider. Kifmann examines the case where supplementary insurance can be used in a risk selection process, but highlights that this situation cannot be Pareto-ranked with respect to the one where both markets are treated as independent.

3.3 Data and empirical methods

3.3.1 Data

We used two sources of data: supply data and consumer data. All information was collected for the year 2007.

Supply data

We constructed a supply database including price information about basic and supplementary insurance markets in 2007. We restricted our analysis to the adult market.

In basic insurance, for any single insurance company prices turned out to be very similar for the different regions within the same canton for each type of contract. Hence, we computed mean premiums within each canton for each company for each type of contract. Accordingly, for each insurance company i within each canton c, the supply database recorded the mean level of premium requested for a given basic insurance contract b (P^b_{ic}). Our source of information was the Federal Office for Public Health (OFSP). We also had information about the number of adult enrollees in any given health plan in each canton (market share).

In supplementary insurance markets, the law does not impose any constraint on the coverage supplied and premiums are risk rated. We considered four types of supplementary coverage: private room hospitalization, semi-private room hospitalization, alternative medicines and dental care. These products were chosen because they are relatively homogeneous across companies (see Choppard 2010 for a discussion) and they belong to the most popular supplementary products. We considered 6 risk categories defined by age (born in 48, 62, 77) and gender. Hence the supply database contained information about premiums offered by each insurance plan (i), per canton (c), per risk category (r), per supplementary insurance product (s) (P^s_{icr}). Information concerning supplementary

insurance was collected via advertised prices, together with phone and website data collection by the authors. Such collection relied on the assumption that the effective premium related to the advertised premium in the same way for each company in a given market.

In 2007, 87 companies were active in the basic insurance market in Switzerland. Of these 60 also offered supplementary insurance. The companies which are only active in the basic insurance market are typically very small and often offer insurance products for historical reasons (e.g. professional funds active before the 1994 insurance reform).Overall, our data base comprised 50,822 observations (one observation per company per canton per risk category and per supplementary insurance product[1]).

The consumer dataset

We used a survey of 3,016 insured individuals conducted by the Institute of Health Economics and Management (University of Lausanne) in 2007 (Dormont, Geoffard, Lamiraud, forthcoming). Surveyed enrollees were a representative sample of Swiss residents older than 26. The survey focused on health insurance choices. In particular, participants were asked about their choices for basic health insurance (i.e. the name of the company they subscribed to, the level of deductible, whether or not they opted for a contract with a restricted choice of physicians) and were requested to report the premium that they had to pay for basic insurance. Respondents were also asked about their choices for supplementary insurance (the type of supplementary coverage they opted for, the name of the company for each supplementary contract, the premium). Respondents were asked whether they had moved from one insurance fund to another during the previous five years (2003- 2007) for basic insurance and whether they intended to switch in the near future. Socio-economic and demographic information was also collected.

3.3.2 Empirical method

We aim at identifying strategic pricing behaviors from insurance companies in Switzerland. In particular, a strategy that seems to take place is low pricing on a given product. As in a loss-leader pricing strategy, a good priced at a low level is supposed to be bought together with other products, which provide most of the profit. It can be that this low-price product generates a loss, or a lower margin. But another possibility is that there is a specialization of the firm on this particular good, and a reduction of its production costs[2]. In this case, the low price product is still a marketing tool, but there is no loss in profit due to its utilization. The first step is to identify potential low price products by firms. The second is to analyze consumers' reactions in the presence of those products.

[1]Some companies do not offer every supplementary product in every canton.
[2]In the case of insurance, this specialization can for instance come through HMO structures.

Identification of low price products

We identify low price product products based on the distribution of premiums across all companies in a given market. A market is defined as a given insurance product (i.e. basic insurance[3], private room hospitalization, semi-private room hospitalization, alternative medicines, dental care), for a given risk category (as defined by age group and gender), in a given geographical area (canton). In each market we define the products for which companies ask a premium lower than the 15th percentile of the premium distribution as the low price products for these companies. The choice of this exogenous threshold was based on the particular structure of the premium distribution (see result section). Sensibility analyses have also been performed.

In order to characterize the market, we determine the number of firms choosing each product to price it at a low-level. At the same time, we examine how many of its supplied products, among the ones that we consider, the firm chooses to advertise, by pricing it at a low level.

Consumers' reactions

Low price product strategy is tested indirectly via consumers' behavior. As low price products are supposed to provide incentives for customers to buy other insurance products in the same company and to induce consumer inertia (i.e. low levels of switching), we expect two main consumer reactions (*i*) that consumers buy other insurance products in addition to the low price products. If this were not the case, a low price product strategy could not be optimal (*ii*) that consumer inertia is reinforced through the purchase of a low price product.

Concerning (*i*), we investigate two main questions depending on whether the low price product concerns supplementary or basic insurance. Are consumers who opt for a low price supplementary product more likely to take out basic insurance with the same company? Similarly, are those who opt for a low price basic insurance product more likely to take out supplementary insurance coverage with the same company? In order to answer the first (second) question, we use Chi-2 statistics to compare for each supplementary (basic) product, the percentage of enrollees having basic (supplementary) coverage with the same company as for their supplementary (basic) coverage among those opting for and those not-opting for low price products.

Concerning (*ii*), we test whether consumers buying a low price supplementary product are less likely to move to another company for basic insurance. We estimate an intention to switch model in basic insurance as follows:

[3]For the basic insurance, we build the ranking according to the most frequently chosen deductible which is the lowest possible deductible (300 CHF). The ranking of the premiums on other deductibles is largely comparable.

$$y_j^* = LL'_{js}\beta + S'_{js}\eta + g'_j\gamma + X'_j\alpha + u_j$$

In this model, j denotes the individual, s denotes the type of supplementary insurance product ($s = 1, 2, 3, 4$). The latent variable y_j^* is based on the observed variable y_j which can take two values: $y_j = 1$ if the individual j intends to switch in the near future and $y_j = 0$ if she/he does not. S_{js} is a vector of supplementary insurance products. $S_{js} = 1$ if the individual j has a contract for product s. LL_{js} is a vector of low price supplementary insurance products. $LL_{js} = 1$ if individual j has opted for one of the low price products in market s. g_j represents the potential gains from switching health plans. It is measured as the (weighted) standard deviation in health plan premiums within a Canton as in Frank and Lamiraud (2009). This represents the expected difference in price one would experience if the typical person switched to the mean plan in a Canton. X_j is a vector of individual characteristics. u_j represents the disturbance which is supposed to follow a normal distribution. We also control for cantonal fixed effects. Having β negative and significant would suggest that buying the low price product limits switching behavior.

3.4 Results

3.4.1 Insurance prices

Table 3.1 displays the mean monthly premium for basic insurance and for each of the studied supplementary insurance products in CHF computed from the supply database.

Basic insurance offers a comprehensive package, but is quite expensive with a mean premium equal to 287 CHF for contracts with a 300 CHF deductible. Note that the mean presented here includes important variations, an important part of which being due to intercantonal variations. However our method for defining low price products rules out any difficulties with this problem in analysis.

Not surprisingly, private room hospitalization is the most expensive supplementary package. The mean premium amounts to 141 CHF. The variance is also very large and mostly reflects intercantonal variations. Semi-private room hospitalization coverage is the second most expensive supplementary insurance product with a mean premium equal to 90 CHF. Dental care and homeopathy supplementary coverage are less expensive products and price variation is much lower.

Again, a market is defined as a given supplementary product, for a given risk category (age, gender) in a given canton (hence there are 4(products)*3(age categories)*2(gender)*26(cantons) markets, i.e. 624 markets). The distribution of premiums shows, in the vast majority of the markets, two clear groups. It usually exhibits a first mass of firms pricing at a low level. Other firms are usually pricing at around the same higher level but it happens that, for some markets, we observe a more continuous distribution of premiums, above

the first group. We identify the first group of firms as those offering low-price products. The threshold of 15% was chosen to identify the first group of firms. We use the same threshold for every market. To illustrate this approach, figure 3.1 shows the premium distribution for dental care insurance, for all risk classes, in the canton of Zurich. This 15th percentile threshold might seem somewhat arbitrary. We also tested other thresholds for a sensitivity analysis (between the 5th and 20th percentile).

By construction, every market will exhibit some low price products. In each market, we observe between 2 and 29 low price products[4].

Interestingly most firms offer at least one low price product, most offering only one. In Table 3.9, we computed for each firm, the proportion of the markets[5] in which the firm is offering a low price product. The proportions are comprised between 0% and 51%, with a mean equal to 8%. Four interesting observations can be derived from Table 3.9.

First, none of the firms exhibit proportions close to 100%, which means that none of the firms is overall more efficient i.e. offering less expensive contracts for every type of coverage. Also most of the firms are not offering cheap coverage on both the basic and supplementary contracts. Only 12% of the firms are in the position of offering low price products on at least one supplementary product, as well as on the basic insurance.

Second, 76% of firms offer either at least one low price product. 48% of firms sell one of their supplementary products at a low price among the four products that we consider. Note that these firms represent of high proportion of enrollees (48%, and up to 60% if we also consider potential low price products on the basic insurance market). Hence the strategy of discounting one product seems to concern an important part of market activities. We cannot exclude the possibility that the firms that have no low price products among the four products that we consider implement another strategy. However, it is likely that they have a low price product on other types of supplementary coverage (which are not studied in this analysis). For example, one of the largest insurance company in Switzerland, CSS, has no low price products among the products that we analyze. However, on another product (coverage for care outside of the borders of Switzerland), they are offering one of the cheapest product on the market[6].

Third, the low price insurance product differs across companies. Out of the companies that have one low price product, 87% of companies have chosen private room in hospital as a low price product, 83% semi private room in hospital, 12,5% alternative medicine and 25% dental care. Somehow, the firms are engaged in market segmentation where each firm discounts the product that is most appealing to a segment of the population. So each firm chooses a "niche" product for subgroup of the population, and discounts it.

Computing the correlations between the prices of the different product offered by a given firm in a market shows that most of these correlations (67%) are negative.

[4]When 29 firms offer a low price product, these firms mostly belong the same group of firms. They therefore have the same pricing structure on some products.

[5]For each firm, the denominator is the number of markets in which the firm is operating.

[6]We did not analyze this product, due to possible issues of comparability across products. We need homogenous products to compare premiums.

3.4.2 Consumers' behaviors

Basic features of the information provided by the survey are given in Table 3.2.

In 2007, 11.2% of the enrollees intended to switch basic insurance health plans in the near future.

A large majority (87%) of individuals held at least one supplementary insurance product. The average number of supplementary insurance products for an individual was 3.3 ($\pm$1.1). Table 3.3 details individual choices for supplementary insurance contracts. Homeopathy/alternative medicines insurance was a very popular product, chosen by 45.6% of the enrollees. One third of the sample chose hospitalization supplementary coverage. Dental care was chosen by 11.2% of the enrollees.

Most people took out basic and supplementary products with the same insurance provider. This was true for the four types of supplementary products considered here. At the same time, they did not seek the cheapest supplementary insurance contract available. Depending on the product, only from 9.8% (dental care) to 31.5% (homeopathy) chose among the less expensive products on the market, even though the products are homogenous (to some extent).

Table 3.4 displays the percentage of enrollees having basic and supplementary coverage with the same company, depending on whether enrollees have opted for a low price supplementary coverage product or not. The results suggest that those who opt for low price supplementary products are significantly more likely to buy basic insurance with the same company. The results are very strong indeed as 100% of those with a low price supplementary product have basic coverage with the same insurance provider, and of course very significant (p-value of 0). This result holds for each level of risk category. It is interesting to note that individuals choosing low price supplementary products are not different from individuals who do not opt for low price supplementary products with respect to health risk. In particular, self assessed health status and health care utilization (as measured by the number of yearly doctor visits) do not significantly differ between those with low price supplementary products and those without low price supplementary products (Table 3.6).

Furthermore, the basket of goods bought from a given insurer is greater when a low price product forms part of this basket. This result, together with the fact that individuals buying a low price product never buy their products from different providers indicates that a low price product strategy is profitable, as the individual buying a low price product then also buys other goods from the same provider.

The results of the intention to switch model are displayed in Table 3.5. The coefficients on the variables indicating a low price product choice are always negative. Most of them are significant at a 5% level, except for private room hospitalization coverage (significant at a 10% level). Holding a low price supplementary insurance product reduces the probability of an individual announcing his/her intention to switch their basic insurance coverage to

another company. Note that the variable indicating that the individual holds a supplementary insurance contract is not significant, where previous research found an effect. This effect seems to have been driven by low price product strategic behavior, combined with individuals buying other products together with the low price product. Coefficients on individual characteristics are in line with previous findings. Older individuals have a decreased tendency to announce intention to switch, while education, gender and a dummy for Swiss citizenship have no significant effects.

We considered the possibility that the low price product variables might be endogenous in the intention to switch equation. Two mechanisms could take place here. First, those who choose a low price supplementary product might also choose a low price basic insurance product with the same company, simply because they optimize their consumption basket. However this situation is unlikely to happen, individuals that buy low price supplementary products never buy their basic insurance product from another, possibly cheaper, firm. Another possibility is that a firm is more efficient at providing insurance products. Therefore, both its basic and supplementary contracts are cheaper than its competitors. But this interpretation is unlikely as well, as the descriptive analysis shows that few firms are offering low price products on both basic and supplementary markets. This is confirmed by the following test. For each type of supplementary contract, we computed the average premium for the basic insurance for those with a low price supplementary product and those with a non leader supplementary product. The results reported in Table 3.11 suggest that the average premium in the basic insurance in significantly higher for those who have chosen a low price supplementary product. And still, switching is hindered by the purchase of a low price supplementary product.

These results suggest that a low price product strategy based on supplementary products seems to succeed in attracting consumers to insurance plans. As those insured are buying a low price supplementary insurance product, in our sample, they always buy their basic insurance product from the same firm. Furthermore, once consumers have chosen a low price supplementary product, they seem to be locked in.

The picture is different if we look at the possibility of using basic insurance as a low price product. An insured individual buying a low price product in the basic health insurance market is less likely to buy its supplementary products from the same company (Table 3.7). The basic insurance product does not therefore attract consumers toward the supplementary products, while the reverse, attracting consumers on the basic coverage through supplementary products, takes place. The individuals choosing cheaper basic insurance are typically in better health and younger than those choosing more expensive basic insurance (Table 3.8). There is no evidence of differences in socio-economic status between those who opt for cheap basic insurance and those who opt for expensive basic insurance. The pattern that we have for basic insurance could result from risk selection strategies. It might also be the case that those who look for the cheapest basic insurance products are more rational consumers who make informed decisions for each insurance product. Hence they tend to (optimally) take out basic and supplementary products from

two different providers. In conclusion we do not find any evidence of low price strategic behavior based on basic insurance.

3.5 Discussion and Conclusion

Looking at figure 3.1, the distribution of premia for a given product is not homogeneous. For a given ex-ante risk (given sex and age, in a given canton), prices can vary considerably. This is true for every demographic category. We interpret this as evidence of a low price product strategic behavior.

According to economic theory, competition in prices leads to marginal cost pricing for a homogeneous product. In a theoretical approach, we show that if consumer inertia and asymmetric information on pricing exists, it might be optimal for firms to offer a low price product, in order to attract individuals and make profits from other non-advertised products.

Using an exogenous definition of low price products, plausible from a graphical analysis, we identify firms offering a low price product in every market that we consider. Interestingly, the vast majority of firms have a low price product. The few who don't exhibit a low price product may nonetheless have one in the products we do not consider. Firms offering low price products are not the same for the different coverages we consider. For the products that are considered here, which are quite homogeneous across companies, it is very unlikely that differences in prices reflect differences in quality (basket of goods reimbursed).

A low price product strategy based on supplementary products seems to succeed in attracting consumers to insurance plans. As those insured are buying a supplementary insurance product, in our sample, they always buy their basic insurance product from the same firm. Although this propensity is quite strong, it lowers significantly when the supplementary product is not a low price product in its market. The basket of goods bought from a given insurer is also greater when a low price product forms part of this basket. Those who opt for low price supplementary products are less likely to declare intention to switch basic insurance companies in the near future. In this respect, consumers don't respond optimally to price differences across firms. Furthermore, we show that supplementary low price products are bought by both good risks and bad risks and that buyers of low price supplementary products do not significantly differ from buyers of non low price supplementary products with respect to their health status. We do not find evidence of low price product strategic behavior based on basic insurance.

Low price product strategies have been described in the literature (usually under the form of loss-leader pricing) for products such as books, food products, gas. However this has never been highlighted in the context of insurance.

The literature has already discussed consumer inertia in the Swiss health insurance market. Previous research was carried out from a consumer perspective (Frank and Lamiraud,

2009, Dormont et al, 2009). In this chapter we have adopted a supply perspective and have identified an optimal pricing strategy in the presence of consumer inertia.

It is commonly believed that basic and different supplementary insurance contracts are offered in a bundle. Bundles are defined as products which are cheaper when bought together from the same producer rather than separately. In other settings, it has been shown theoretically and empirically that such a strategy can be profitable. However, our analysis suggests that bundling does not exist in the Swiss Health Insurance market.

We implemented a simple test for bundling. For each individual having basic and supplementary insurance contracts from the same company, we computed the theoretical total health insurance premium (sum of basic and supplementary contracts, for each type of supplementary contract) s/he would pay by choosing the cheapest basic product on the market (keeping her/his deductible and HMO choices constant) and staying with her/his current arrangements for supplementary contracts[7]. This combination is entirely feasible, as no insurance company can refuse an applicant for their basic contract, and once a supplementary insurance contract is concluded, it cannot be easily interrupted by the insurance company. We compared the mean of the previous variable to the mean actual total premium that the insured individual was paying for each combination of basic and supplementary contracts at the same place. The results are displayed in Table 3.10. The mean monthly premium paid for a basic and private room hospitalization contract with the same insurer amounted to 543 Swiss Francs. If these individuals switched their basic insurance to the least expensive basic product, the mean premium would be reduced to 479 Swiss Francs. The difference is statistically significant. We have the same pattern for the other supplementary products. Separating the products by buying them from different firms would be cheaper for the insured. We interpret this as evidence against bundling strategies.

Insurance companies in Switzerland have not distributed dividends to their shareholders since the introduction of the health insurance reform in 1994. This feature casts doubts on their objective function being to maximize their profits. Some authors have argued that they might be, in fact, maximizing their market share rather than seeking profit. A firm having to break even and willing to maximize its number of clients can try to attract clients using its advertised products. Even if it makes a loss on such products, it can compensate by selling other non-advertised products. In our empirical analysis, we note that consumers have a tendency to buy other products together with low price products. Insured individuals also have a tendency not to switch insurers once they have bought a low price product, justifying this strategy when the objective is to maximize market share.

This work suffers from a few limitations. First, it ignores the interactions between insurers and health care providers. Limiting the costs can be another way to attract more clients,

[7]Because basic insurance contracts are perfectly homogeneous across companies, the basket of products is unchanged for the individual.

together with a low price product strategy. However, this does not seem to be a major strategy of health insurers, even if this might change in the future. Another limitation is that we chose the low price product threshold endogenously. A sensitivity analysis testing different thresholds does not greatly change the results. A last question that can arise relies on the timing of the purchase of the insurance products. It could be argued that the product was at low price when it was bought by the individual, even though it is not the case anymore. Because of the low-switching rate, the consumers would therefore be trapped with a suboptimal contract. However, there seem to be some inertia on the premium of supplementary insurance. We do not know when individuals subscribed to their supplementary contracts However the group of low price supplementary products has remained stable over time Consequently It is much more likely that the products that we identified as low price products have been low price products since they were bought

The story seems to be different for basic insurance and would deserve further investigation. In particular, the group of low price basic products has changed over time. Some companies are cheap in some cantons but not in other cantons. It seems that some companies start with a low price when they enter the market and then make it rise.

Our identification of the low price products relies on the fact that the products we study are homogeneous. Product differentiation would be another strategy for firms to avoid price competition, and attract consumers. Basic insurance product is, by law, homogeneous. We are confident that the supplementary products that our analysis relies on are fairly homogeneous, despite their price differences. The latter fact is, according to this analysis, best explained by consumers' inertia, and low price product strategic behaviors.

In the presence of consumers' inertia and status quo bias, after having defined exogenously the low price products in the Swiss health insurance markets, we have shown that most of the firms choose some form of low price product. Consumers, when buying a low price supplementary product, always buy their basic insurance product from the same firm. The difference with individuals not buying low price supplementary products is significant. The status-quo bias is encouraged by the purchase of low price products. Switching is significantly reduced when consumers have chosen a low price supplementary insurance.

Low price product strategy in the Swiss health insurance hinders competition. This strategy can, at least in part, explain the non-convergence of premiums that market provision was supposed to implement. Because basic insurance provision is supposed to be social, the existence of pricing strategies is problematic. On the supplementary insurance provision, however, it is perfectly legitimate that firms implement profit maximizing strategies. Joint provision of the two different types of insurance should probably be reformed in Switzerland.

3.6 Appendix

Figure 3.1: Private room hospitalization supplementary insurance monthly premium, CHF

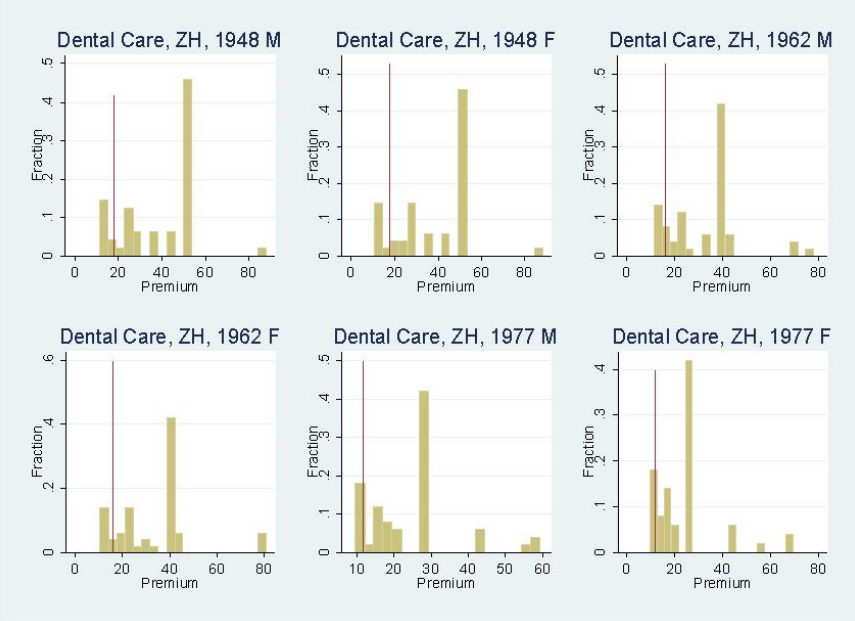


Table 3.1: Monthly premium of basic and chosen supplementary insurance, CHF

Type of health insurance	**Mean**	**Std. dev**
Basic insurance (300 CHF deductible)	287	65
Private room hospitalization	141	78
Semi-private room hospitalization	90	47
Dental care	32	16
Homeopathy	17	5

Table 3.2: Descriptive Statistics: Consumers individual characteristics (percentages)

Variable	%
Age: [27,35]	12.7
Age: [35,50]	35.01
Age: [51,65]	29.31
Age: >65	22.98
Household Income: < 5000 Swiss Francs per month	29.05
Household Income: 5000 - 8000 Swiss Francs per month	29.77
Household Income: > 8000 Swiss Francs per month	29.18
Missing value for income	12
State Subsidy for the Premium (yes=1)	16.96
Gender: male	46.35
Education level: first cycle regular track (compulsory school)	10.74
Education level: second cycle regular track	8.19
Education level: short professional track	49.01
Education level: long professional track	14.46
Education level: university completed	15.82
Urban setting	
Poor subjective health	16.55
Good subjective health	44.83
Very good subjective health status	38.4
Employed	63.53
Swiss citizen	86.34
Intends to switch in the near future	11.20%
Intends to switch in 2008	5.20%

Table 3.3: Proportion of the sample buying a supplementary insurance, a supplementary insurance in the same firm in the same company as their basic insurance, and the proportion buying the low price product

	% having supp. coverage	**% having supp.coverage with the same company as for basic insurance**	**% with low price product (suppl.)**
Private room in hospital	11.7	83	20.4
Semi-private room in hospital	21.4	88	25.0
Dental care	11.3	92	9.8
Homeopathy/ alternative medicines	45.8	89	31.5

Table 3.4: Proportion of the sample buying their basic and supplementary coverage from the same firm, depending on their purchase of a low price supplementary product

	% having basic coverage in the same company			**% with low price product (suppl.)**
	without low price product for supp.coverage	with low price product for supp.coverage	Chi2	
Private room in hospital	79	100	18.15	20.4
Semi private room in hospital	84	100	28.72	25
Dental care	88	100	13.47	9.8
Homeopathy and alternative medicines	87	100	18.81	31.5

Table 3.5: Intention to switch empirical model

	Coef.	**z**
low price product for private room in hospital	-0.11	-1.62
private room in hospital	-0.20	-0.98
low price product for semi private room in hospital	-0.61**	-2.17
semi private room in hospital	-0.03	-0.18
low price product for dental care	-0.28**	-2.24
dental care	-0.16	-0.89
low price product for homeopathy/alternative med	-0.63**	-1.98
homeopathy/alternative medicines	-0.09	-0.95
g	0.02*	1.91
male	0.12	1.28
poor subjective health	ref	ref
good subjective health	-0.09	-0.65
very good subjective health status	-0.21	-1.37
age: [27,35]	ref	ref
age: [35,50]	-0.45***	-4.00
age: [51,65]	-0.74***	-5.58
age: >65	-1.92***	-5.65
education level:compulsory school	ref	ref
education level: short professional track	-0.03	-0.16
education level: second cycle regular track	0.20	0.90
education level: long professional track	0.19	0.93
education level: university completed	0.08	0.39
swiss	-0.01	-0.06

*** significant at 0.01%, ** significant at the 0.05%, * significant at 0.1%

Table 3.6: Health status, physicians and hospital visits, depending on the choice of a low price supplementary product

	Very good subjective health status (%)	**Number of contacts with a physician in 2006 (mean)**	**Had a hospital stay in 2006 (%)**
Private room in hospital			
with low price product	40.85	3.81	13.89
without low price product	47.62	4.04	13.5
p*	0.38	0.75	0.932
Semi-private room in hospital			
with low price product	40.37	3.95	14.91
without low price product	36.9	4.54	14.88
p*	0.432	0.303	0.995
Dental care			
with low price product	40.19	3.9	9.35
without low price product	41.48	3.78	13.97
p*	0.822	0.82	0.232
Homeopathy/ alternative medicines			
with low price product	36.76	4.3	10.29
without low price product	40.36	4.19	10.8
p*	0.417	0.84	0.857

*comparison of characteristics between the group with low price products and the group without low price products

(Chi 2 test and student test for mean comparisons, respectively for dichotomous and continuous variables)

Table 3.7: Proportion of the sample buying their basic and supplementary coverage from the same firm, depending on their purchase of a low price basic product

	% with supplementary coverage from the same company		**p**
	without low price product for basic insurance	with low price product for basic insurance	
Private room in hospital	87.88	58.18	< 0.001
Semi private room in hospital	90.74	71.91	< 0.001
Dental care	92.77	69.83	< 0.001
Homeopathy and alternative medicines	94.6	83.05	< 0.001

Table 3.8: Health status, physicians and hospital visits, depending on the choice of a low price basic product

	without low price product for basic insurance	**with low price product for basic insurance**	**p**
Very good subjective health status (%)	37.35	43.55	0.007
Number of contacts with a physician in 2006 (mean)	4.24	3.09	< 0.001
Had a hospital stay in 2006 (%)	12.74	8.42	0.005
First cycle regular track (compulsory school) (%)	11.24	8.59	0.067
age (mean)	54.22	49.13	<0.001
Income (mean) (1 - 11 scale)	5.34	5.32	0.897

Table 3.9: Firms and the proportion of low price supplementary products they have chosen

Insurer name	**insurer ID**	**% of supplementary products sold at a low price**
CSS Kranken-Versicherung AG	8	0.00
Krankenkasse Aquilana	32	0.23*
SUPRA CAISSE-MALADIE	62	0.13
Caisse Maladie de la Fonction Publique	160	0.00
PROVITA Gesundheitsversicherung AG	182	0.11*
Sumiswalder Kranken- und Unfallkasse	194	0.05*
Caisse-Maladie EOS	216	0.00
Carena Schweiz	261	0.06
Bau- und Holzgewerbe SKBH	263	0.00*
CONCORDIA	290	0.08
Atupri Krankenkasse	312	0.32*
Avenir Assurances	343	0.00*
KPT CPT Krankenkasse	376	0.51*
Xundheit	411	0.23
Caisse-maladie Hermes	445	0.00*
ÖKK Kranken- und Unfallversicherungen AG	455	0.34
PANORAMA Kranken- und Unfallversicherung	484	0.00*
Öffentliche Krankenkasse Basel	509	0.34
Versicherungsverein St. Moritz	556	0.00
La Caisse Vaudoise	749	0.00*
Kolping Krankenkasse AG	762	0.12
Krankenversicherung EASY SANA	774	0.00
Die Eidgenössische Gesundheitskasse	881	0.00
Progrès Versicherungen AG	994	0.02*
Krankenkasse Visperterminen	1040	0.34
Wincare Versicherungen	1060	0.00*
AVANTIS-Assureur maladie	1097	0.00
AUXILIA Assurance-maladie	1159	0.00*
Caisse-maladie de Troistorrents	1215	0.00*
SWICA Krankenversicherung	1384	0.00
Galenos Kranken- und Unfallversicherung	1386	0.00*
ÖKK Öffentliche Krankenkasse Schweiz	1395	0.34
Betriebskrankenkasse Heerbrugg	1401	0.12
Fondation Natura Assurances.ch	1442	0.00
Mutuel Assurances	1479	0.00*
Fondation AMB	1507	0.00
Sanitas Grundversicherungen AG	1509	0.00*

Insurer name	**insurer ID**	**% of supplementary products sold at a low price**
Société suisse des hôteliers	1520	0.00
Intras - Caisse Maladie	1529	0.33
Caisse maladie-accident Philos	1535	0.00
Assura, assurance maladie et accident	1542	0.33*
Caisse-maladie et accidents Universa	1551	0.00*
aerosana versicherungen	1552	0.00*
Visana	1555	0.09
Agrisano	1560	0.00*
Helsana Versicherungen AG	1562	0.00*
avanex Versicherungen AG	1565	0.00*
sansan Versicherungen AG	1566	0.00*
Sana24	1568	0.09
Arcosana AG	1569	0.00*

* these companies sell basic insurance at a low price

Table 3.10: Bundling test

	Mean current premium when buying supp. and basic coverage from the same company	**Mean theoretical premium when buying basic coverage from the cheapest company**	**p**
Private room in hospital	543	479	< 0.01
Semi private room in hospital	458	398	< 0.01
Dental care	376	316	< 0.01
Homeopathy/alternative medicines	359	306	< 0.01

Source: survey data

Table 3.11: Premium proposed for the basic coverage, depending on the choice of a low price supplementary product

	Mean premium in basic insurance		**p**
	without low price product for supp.coverage	with low price product for supp.coverage	
Private room in hospital	266	285	< 0.01
Semi private room in hospital	265	287	< 0.01
Dental care	260	298	< 0.01
Homeopathy and alternative medicines	239	264	< 0.01

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