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ON THE FUZZY BOUNDARIES BETWEEN PUBLIC AND PRIVATE IN HEALTH CARE ORGANIZATION AND FUNDING SYSTEMS[^]

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Abstract. The paper proposes a survey of health care organization and funding systems in order to underline and discuss, in this specific field of social assistance, the combination public versus private provision and production of services. The survey then examines the present features of various National health services focusing on the efficiency and equity of public intervention and on the industrial organization of the institutional design of health care. In this context, it treats the rationale of cost-benefit of vertical integration of structures, devoted respectively to purchasing and providing health care services. Further, the paper considers the advantages and disadvantages of managed competition in quasi-markets and, finally, it deals with insurance systems, social as well private and supplementary ones. From the survey it turns out that the main distinctions of health care regimes in industrialised countries are not in terms of private versus public ownership of providers, rather in terms of industrial organization setting and in terms of the proportion of public versus private expenditure.

Keywords: Health care organization, health care funding, social insurance, private and public provision

JEL Classification: I1, H1, H4,

1. Introduction

The paper presents a systematic study of health care organization and financing models in order to analyse the boundaries between public and private involvement in this sector. Indeed, health care supplies an exemplary “case study”, enlightening all the possible ways of designing and structuring the public intervention in welfare economics.

In industrialised countries, the public intervention in health care is realised by several regimes of organization and financing, and none has an absolute supremacy over the others in terms of productive and allocative efficiency, equity and fulfilment of the implicit social rights. Therefore, for the economists, health care organization is a very ticklish and scientifically stimulating topic, especially if they are free by prejudices of school or even ideological, which instead in this field easily tend to get up.

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In analysing and evaluating the various organizational and funding systems we cannot leave out some preliminary considerations about health care policy in the main industrialised countries. First, in this field, there is a strong pressure on public as well private expenditure. Indeed, from the supply side, the sector is characterised by a long run costs inflation process due to the shifting up of medical technological frontier and to the consequent dynamics of quality of care (Cutler 2002). Moreover, from the demand side, there is an expenditure shift due to population ageing and other demographic processes (OCDE 2009, Zweifel et al. 2009, ch. 1). Second, it is a sector where there are a huge number of economic agents, with different and often conflicting preferences and interests, and consequently pay-off functions. Therefore, it is illusionary and vain to hope to convey the whole non-cooperative "game" in a unitary and centralised decision-making, as if it would be a cooperative one. Third, whatsoever the chosen organization, its outcome depends directly on the flow of incentives that are distributed among the agents. In this respect, for instance, fully planned *command & control* systems, which are not as well *incentive-compatible*, can result, though the best intentions, deeply inefficient and inequitable.

Indeed, according to the modern economic theory, health care systems are successful in attaining their aims if they can optimally combine the incentives of physicians, patients, providers, and funding entities, for producing and supplying health services at a quantitative and qualitative level coherent with the effective need, containing production costs and optimally allocating public and private resources among the agents themselves. Within each health care organization there are several principal/agent relationships with asymmetric information whose framework influences dramatically the decision making outcome. Consequently, it is crucial to have a system of incentives and delegations able to boost all the informed agents to choose strategies coherently with the objectives of the uninformed organization (Zweifel et al. 2009, ch. 11).

The distribution of incentives among economic agents, with different and independent pay-offs, reminds in some sense a notion of competitive market, characterised by complex structures of demand and supply. In this regard, the connection of market and competition notions to health care is considered, by many scholars of disciplines not in the field of economics, as improper because not compatible with the social nature of the implicit rights. One of the aim of this work is to explain if, and at what conditions, this link, often pursued for efficiency aims, can be compatible also for equity concerns. However, market and competition, must to be considered as independent notions from the one of privatization of health insurers and providers. Indeed, in some health care system, competition is fully running within the public sector of the economy, in the so called "internal markets" (Le Grand 2007).

The plan of the work is as follows. In section 2, the distinction between public (private) provision and public (private) production of health services is examined. From these two concepts it obtains the design of the various *organizational* and *financial models* in industrialised countries, given for granted that organizing in industrial terms and funding a health care system are two different issues and two different economic problems, although, of course, linked each other. We also attempt to classify organically the several models, in order to include them in a restricted number of conceptual containers. In section 3, we are following a typical *Industrial Organization* (I-O) approach at looking for the efficient health organization throughout the cost-benefit of separation or integration of health funding agencies, i.e. insurance companies and health districts, from productive and supplying entities, i.e. hospitals, clinics, fund-holders and medical laboratories. In section 4, we examine the various financing and social insurance systems, with a specific analysis of the so called multi-pillar regime. Section 5 concludes with some summarizing, although of course not conclusive, comments.

2. Public provision vs. public production of health services

2.1 Health services and individual well-being

Health services, like general practitioner and specialised medical examinations, diagnostic tests, admissions to hospital, medicines, are devoted to treat a state of sickness, aiming at a adequate level of individual health (Culyer 1989). According to the classical notion coined by Amartya Sen, health is a *functioning*, extensively influencing, as liberty, nourishment and basic education, the individual level of *well-being* (Basu and Lopez-Calva 2010, Fleurbaey 2009). However, the individual health level does not derive only from the consumption of health services, but mainly from the efficiency of a peculiar household production process, depending on his/her personal life style. The latter process, on the other hand, works in a social context given by several meaningful variables, as the environmental conditions, the society level of knowledge and culture, the distribution of wealth, etc.

With reference to microeconomics of consumption, health services are private goods, since they are both rival and excludable, but are not direct consumption commodities, as a loaf of bread or a glass of wine. They are, instead, intermediate goods, working as inputs in the household productive process determining the level of "health functioning" (Hurley 2000, Zweifel et al. 2009, ch. 3, Anderson and Grossman 2009). In formal terms, let define as $m=(m_k, k=1..M)$ the vector of M health services to treat a status of sickness, indicated by s , a measure of need. Then, let define with H the level of health

reached by the individual, a measure of human capital stock (Grossman 2000, Becker 2007). Consequently, the individual i well-being may be represented as follows:

$$U^i = U^i(x_i, H^i) \quad (1)$$

$$H^i = h^i(s_i, \mathbf{m}_i) \quad (2)$$

According to (1), the level of utility achieved by individual i depends on the direct consumption of a private composite commodity x_i , the *numeraire*, and by the functioning "health" H^i . According to (2), i "health functioning" depends on the initial state of health, s_i , combined with the use of M health services, as described by the production function $h^i(\cdot)$, embedding as well the effects of environmental and social conditions and the life style. Given this technology any health service j has a positive, not-increasing, marginal

productivity, $\frac{\partial h^i(\cdot)}{\partial m_j} \equiv h_j^i(\cdot) > 0$, $\frac{\partial^2 h^i(\cdot)}{\partial m_j^2} \equiv h_{jj}^i(\cdot) \leq 0$, $j = 1, \dots, M$. The sign of cross-derivative

h_{jl}^i depends instead on the relationship of complementarity or substitutability between services j and l . h_j^i formalizes the notion of "appropriateness" of j on health care of individual i , as ex-ante specified by the physician along the medical protocols.

In this particular context, the consumer equilibrium is given by the following condition

$$SMS_{j,x}^i \equiv \frac{U_H^i h_j^i}{U_x^i} \equiv SMS_{H,x}^i h_j^i = P_j^i. \quad (3)$$

According to (3), the *marginal benefit* of care throughout the service j , $SMS_{j,x}^i$ is a measure of willingness to pay, given by the marginal utility of health (in terms of *numeraire*), $SMS_{H,x}^i \equiv \frac{U_H^i}{U_x^i}$, weighted with the appropriateness index h_j^i . In equilibrium

$SMS_{j,x}^i$ must be equated to the out-of-pocket individual's cost of service, P_j^i , as a fraction of the producer price (marginal cost): $P_j^i = \eta_j^i MC_j$; $\eta_j^i \leq 1$. This opportunity cost the individual i faces specifically reflects the health care financing system. In general, the fraction η_j^i is less than one because the service is not paid at "full price". The financing of the latter may derive, from insurance premiums, from social contributions, or from the general tax system funding a National Health Service (NHS). It may, at the most, include a moderate *co-payment*, (sub-sections 2.2.1. and 2.2.2 and section 4). Clearly the lower is η_j^i , the lower is the strength of the scarcity signal sent to agent i by the opportunity cost.

2.2 From the rationale of public intervention to health care systems typologies

The modern theory of *Public Economics* singles out a set of reasons for the public intervention in the organization and provision of health services. The motivations follow both efficiency and equity concerns (Hurley 2000, Zweifel et al. 2009, ch. 5).

2.2.1 Efficiency and public provision of health care

First, although, as said, health services are private goods, nevertheless they often produce *positive externalities*, as their benefits spread also to people not directly consuming them. Vaccinations and the large part of preventive medicine provide the most emblematic cases. By consuming only according to private economic calculus it would determine a social under-provision of the service, thus a public provision for internalizing the effects becomes socially desirable.

Second, health services are often *merit goods*, for whom a social (paternalistic) preference is adding to, or even substituting, the private one. The merit good argument is linked to imperfect (myopic) individual evaluation of the benefit of a commodity consumption. When a health service has this feature, its consumer price should be subsidized, until, if necessary, the total exemption (sub-section 2.2.2).

Individuals have *imperfect information* on the features and the expected benefits of treatments. In general, health services are *experience goods*, a specific category of commodities whose quality is, according to I-O theory, ex-ante unknown, and can be perceived only ex-post (Ba-Isac and Tadelis 2008, Belleflamme and Peitz 2010). In health care, it is the services productivity and efficacy to be unknown before the consumption. Sometimes health services tend to be also *credence goods*, when their quality is never ascertained. In this informational framework the crucial agency relationship between the physician (the more informed agent) and the patient (the uninformed principal) cannot be leaved to a private contract, unable to bound the former from inducing the latter to consume what and how he wants for personal aims. This argument supplies the justification for designing specific public contractual relationships between the state and general practitioners, in order to reduce search costs and increase confidence by patients (Mc Guire 2000, Dranove and Satterthwaite 2000).

Facing health care spending, given uncertainty and risk aversion, the individual has an incentive to buy insurance. However, in this context we have the well known cases of *market failure*, due to asymmetric information between insurer and insured. In particular, the phenomena of ex-post *Moral Hazard* (MH) given by "the third party purchasing", TPP, context (Nyman 1999, Pauly 2000, Zweifel and Manning 2000, Chalkley and Khalil 2005), and of *Adverse selection* (AS) (Zweifel et al. 2009, ch. 5 and 6), generally imply the non-

existence or the inefficiency of insurance market equilibria. In these cases a *social insurance* can guarantee, at some condition, welfare-improving equilibria w.r.t private second best Pareto-constrained equilibria (Cutler e Zeckhauser 2000, Zweifel et al. 2009, ch.5 and 6).

In presence of MH, it can be shown that a risk-sharing equilibrium with partial coverage can be improved in a NHS organization by a higher coverage and by a system of controls, provided the decentralised entities are effectively constrained by “hard” budget constraints. However, a system of co-payments may still be desirable for risk-sharing also in a NHS. In case of AS, it can be proved that a *Rothschild-Stiglitz separating equilibrium* (RSSE) can be improved by substituting it with an uniform average premium, a *Community rating insurance* (CRI) with cross-subsidization. Further, this average premium can be also substituted by a system of social health contributions, as payroll taxes, or by specific taxes dedicated to funding a NHS (section 4).

A little bit of formalization on private insurance failure can be useful later on. Let us start with a ex-post MH-TPP context. With $y=Y-\pi-E+I=Y-\pi-E+(1-k)E$, $0 \leq k \leq 1$, we represent the individual disposable income, equal to gross income Y less the premium π and the health service expenditure E plus the benefit of insurance (reimbursement), $I = (1-k) E$, where k is the coinsurance rate. $u(y)$ is the status dependent wealth utility¹, with the usual risk-averse hypotheses, and $EU(y)$ the expected utility, where the “sick status” has probability p and the “healthy status” $(1-p)$. The optimal second best coinsurance rate $k^* > 0$ (with a loading factor d) may be given as follows²:

$$\frac{1-k^*}{k^*} = \frac{\theta}{\varepsilon_{Ek}} \quad (4)$$

where $\theta \equiv 1 - \frac{u_y^s}{(1+d)EU'(y)} < 0$; $EU'(y) \equiv pu_y^s + (1-p)u_y^h$ and $\varepsilon_{Ek} < 0$ is the elasticity of

E w.r.t. k . Condition (4) manages a trade-off between the aim of risk-sharing and the aim of controlling the level of over-spending in E , and it is similar to Ramsey inverse elasticity formula of optimal commodity taxation. The level of optimal coinsurance rate can be translated in a optimal co-payment, positively related to price elasticity; so it should be high for service with high elasticity and zero for services with zero elasticity (services for chronic pathologies and diseases)³. The alternatives to the co-payment, for controlling the MH-TPP over-spending effect, may be the consumption rationing by

¹ This representation of preference may derive from utility function (1) and (2) by assuming that there is only a treatment and two health status (“healthy” and “sick”) and that the consumer, by purchasing the treatment, can precisely re-establish the healthy status before sickness (Hoel 2007).

² The condition is obtained in many theoretical contexts. See for instance Cutler and Zeckhauser (2000), Pauly (2000), Zweifel et. al (2009, p. 237-240).

³ The co-payment could be, of course, also personalised, i.e. graduated in terms of the income and the need of the patient.

lengthening the waiting lists (Gravelle and Siciliani 2008), harder budget constraints and taxes increase. All these alternative might be even more distortionary than the co-payment.

Now let us have a look to a standard AS context. Given two types of individuals with high, h , and low, l , probability of illness, $p_h > p_l$, and with fractions of population respectively of λ and $(1-\lambda)$. Let π_i , $i=h,l$, be the premium for a contract giving a reimbursement I_i of the health service expenditure E , with $I_i \leq E$. As said, the RSSE, with the share of low risks sufficiently small in order to guarantee its existence, implies a structure of premiums and insurance coverage as follows

$$\pi_h = p_h E; \pi_l = p_l I_l \text{ with } I_l < E \quad (5)$$

while the social insurance Pareto-superior (both types are better off), in terms of mandatory pooling solution, may work with a CRI p^a as follows

$$\pi_h = p^a E = \pi_l; p^a = \lambda p_h + (1-\lambda) p_l \quad (6)$$

where there is an implicit cross-subsidization taxes-transfers structure from l to h :

$$t_l = (p_l - p^a)E = -\lambda (p_h - p_l)E < 0; t_h = (p_h - p^a)E = (1-\lambda) (p_h - p_l)E > 0; \lambda t_h + (1-\lambda)t_l = 0.$$

The insurance market failure arises also for those individuals whose probability of illness is near to one (elderly people, poor and socially excluded individuals, chronic invalid individuals) which could be cream-skimmed by private insurers. The coverage of these high risks can be guaranteed only by a social universal insurance system.

2.2.2 Equity and public provision in health care

Equity in health care pursues a notion of *equity of outcomes*, by guaranteeing the opportunity to reach a given level of health to all individuals, independently on their economic, social and territorial conditions and status (Williams and Cookson 2000, Wagstaff and Van Doorslaer 2000). The *final objective* is to allow *human capabilities*, such as the recovery of physical functionality, the absence of complications and a adequate life expectation, and to realise at least a decent level of *health functioning*. In formal term, using (1) and (2), the health care system should satisfy these two conditions:

$$s_i = s_u \Rightarrow m_i = m_u \text{ and then } H^i = H^u \text{ iff } h^i(.) = h^u(.) \quad (7)$$

$$s_i < s_u \Rightarrow m_i \geq m_u \quad (8)$$

According to (7), if two individuals, i and u , have equal initial health status, they should have the possibility to access to the same vector of services and then to be potentially able to reach the same level of health. The sole differences should depend on the parameters of the household production function and then on the life style. According to (8), the individual i , with a worse initial health status than individual u , should accede

to a vector of services with at least one component strictly greater. Thus, this principle of health equity tends to reduce the differences in the initial level of health along the basic *equality of opportunity* idea of “...more resources for less talent...”. However, the ways to actually reach, or approximate, this final result depend on some feasible intermediate objectives. Indeed, several notions of universalistic provision of health care are actually pursued by the various systems, especially for specifying the prevailing funding criteria.

First, we have the simple notion of *Equality of per-capita expenditure*, when the funding of decentralised public bodies is designed to equate per-capita public spending, possibly weighted with socio-demographic variables. Second, we have the *Equality in satisfying standardised needs*, when the funding is referred to the notion of Essential levels of health care (ELC) and standardised costs per treatment. Third, it is frequently evoked the notion of *Equality of access to services*, essentially meaning that the providers are obliged to guarantee an equal treatments to patients, independently on individual risk (no cream-skimming) and income (no wealth discrimination). Finally, we may remind the concept of *Equality of individual payments*, when a uniform per-patient cost for health care treatments is required (no price discrimination). These intermediate objectives are actually attainable, but, could be conflicting each other and, in any case, they obtain only second best equity conditions, as they are imperfect and constrained respect to the first best one (fulfilment of a adequate level of “functioning health”).

Particularly meaningful is the second notion, referring to the criterion of guaranteeing a essential package of care covered by public funding, for which we may propose to follow the merit good argument along this simple formalization (Schroyen 2005, 2010).
Let

$$TWP_i \equiv \varphi_i(m_i, Y_i, \bar{v}^i) \quad (9)$$

be the function of the total willingness to pay by i for the treatment m_i , given his income Y_i and utility level $U^i(.) = \bar{v}^i$ (the desired well-being). Consequently the marginal willingness to pay is as follows:

$$MWP_i = - \frac{\partial \varphi_i(m_i, Y_i, \bar{v}^i)}{\partial m_i} \quad (10)$$

If the government is committed to guarantee to every citizen the access to a ELC of m , it is reasonable to think that the government gives to the treatment a higher marginal evaluation than that one recognised by the individual himself:

$$MWP_i^G = MWP_i + \omega_i(m_i) \quad (11)$$

Therefore TWP_i^G , i.e. the amount of *numeraire* the individual *should*, according to government evaluation, be available to give for buying the treatment m_i and reaching the desired utility level \bar{v}^i , obtains as:

$$TWP^G \equiv \varphi_i^G(m_i, Y_i, \bar{v}^i) = \varphi_i(m_i, Y_i, \bar{v}^i) - \int_{m_0^G}^m \omega_i(\chi) d\chi \quad (12)$$

m_0^G is the level of the service behind which the public marginal evaluation is deviating from that one of the individual as such. It can be shown that to (12) it corresponds the level of well-being $U^g(m_i, Y_i) = U^i(m_i, Y_i + \int_{m_0^G}^m \omega_i(\chi) d\chi)$, achievable with a lump sum subsidy to i . Alternatively, the consumer price for the service i has to face must be lower than the producer price, in order to push his consumption over the level he otherwise would choose, until the specified essential level.

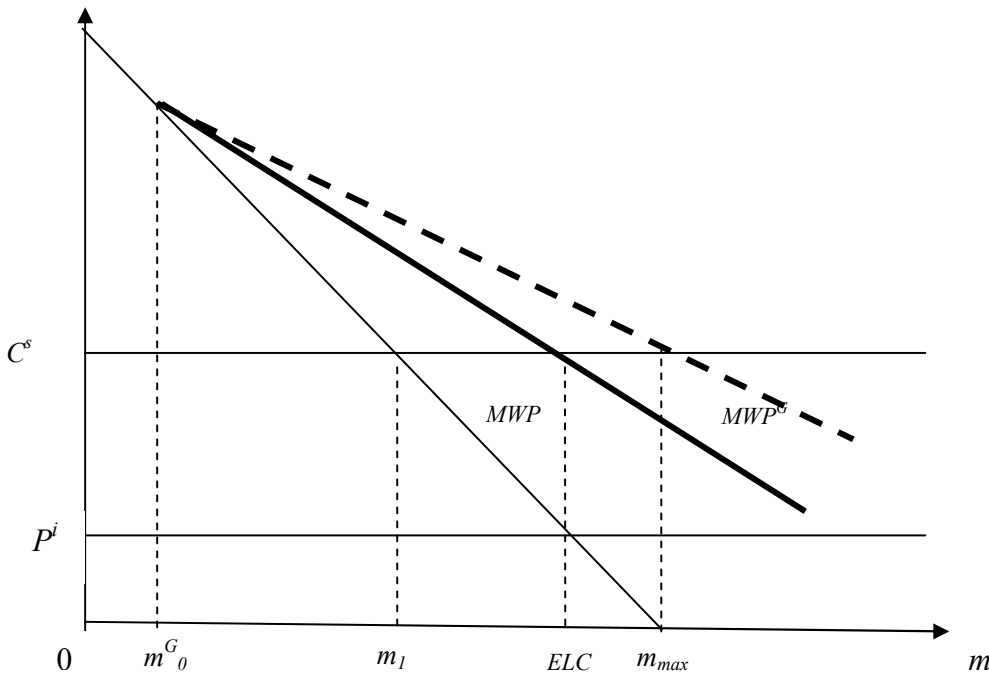


Fig.1: Social service and access to the essential level of health care

The expression $-\int_{m_0^G}^m \omega_i(\chi) d\chi$ represents the area of Fig. 1 between the two curves of marginal evaluation, by the government and by the individual, thus the area of public responsibility for the service provision. In the horizontal axis of Fig. 1, $m_1 > m_0^G$ is the market solution where the private MWP is equal to the marginal (standardised) cost C^s . ELC is the consumption socially guaranteed, given by crossing curve MWP^G with C^s line, which corresponds, at the same time, to the level at which private MWP curve is crossing the co-payment line $P^i < C^s$. Notice that the co-payment is zero when the MWP^G is the dotted curve, $ELC = m_{max}$ and the whole expenditure is bearded by the government.

2.2.3 Industrial configuration failure and public production of health care

The previously mentioned equity and efficiency concerns offer the rationale for public intervention in terms of *public provision* of health services, i.e. by funding them outside the price-setting, independently on the nature and ownership of the chosen providers. However, for some treatments, it may occur situations of “industrial configuration failure” where is socially desirable to join together *public provision* and *public production* as well. When it is convenient to localize services provision in urban areas where the private returns to invested capital are higher and there are economies of scale, local monopolies can easily take place for extracting spatial rents. Elsewhere, with lower expected returns, it may instead turn out a scarce network of providers and then an excess-demand of services. In these cases, the public sector should be engaged not only to funding the services, but also to providing them directly, in order to support a fair territorial distribution of supply. The inadequacy of supply and the rationale of public production also occurs when, in some territories, the network of private providers, although numerous ones, can not supply high-quality services. In these cases of inefficient industrial structure, public production, if well organised, is justified both for efficiency and equity aims.

In Table 1, we summarize the ways health care may be organized. The distinction between public (private) provision and production is crucial in order to analyse and classify the several models of health care. Indeed, the production argument allows us to talk about *health care organization* of supply, while the provision argument to talk about *health care financing* of medical expenditures. Both these two items contribute to define the features of a health care system.

Table 1 **Private vs. public in health care**

	<i>Private provision</i>	<i>Public provision</i>
<i>Private production</i>	<i>Private</i> providers costs covered by insurance premiums	<i>Private</i> providers costs burdened by <i>public</i> expenditure
<i>Public production</i>	<i>Public</i> providers costs partly covered by co-payment and out-of-pocket expenditure	<i>Public</i> providers costs fully funded with <i>public</i> expenditure

2.3. *Health care systems and coverage of risk diseases*

To begin with we may distinguish two polar organizational systems. First, there is the *Public system*, which in the purest version, the so called *Beveridgian* model, considers full public provision and production of health services, both financed by general taxation. Essentially, the English and Italian NHSs, before the reforms of the last two decades, were following this model. It is also a public model the original social insurance model

financed by health contributions going directly to public Health Funds, the so called *Bismarkian model*. In principle, both previous models are universalistic ones. Second, there is the *Private insurance system*, presently still working in U.S.A., with a prevailing structure of private insurances policies and only some public programs for specific categories of patients and limited fractions of population: the *Medicare* for elderly people (over 65 years-old) and *Medicaid* for poor people (selected by means testing). This health care system is coherent with the concept of "residual welfare state" implying a limited coverage of every social risk⁴. However, these two polar models are now mainly academic ones and statistical outliers. For instance, all European countries are now applying *mixed systems*, where public and private programs are acting simultaneously for guaranteeing a universalistic provision of health services. Also the American system, according to the Barack Obama's reform, by introducing a set of innovations w.r.t the previous *Private insurance system*⁵, is going to be transformed in a mixed one (Sullivan 2010).

The long and deep discussion on Obama's reform clearly has shown that, in order to evaluate the different systems, it is crucial to precise what is meant with degree of *health care coverage* of each one. However, this notion is not unique as it may be referred to: (i) the *extent* of coverage, i.e. the share of population whom health care is guaranteed; (ii) the *depth* of coverage, i.e. the number and the features of services included in the insured package; (iii) the *highness* of coverage, i.e. the fraction of treatment costs directly financed by the insurer or the NHE and then not directly paid by patients. This classification must be taken into account for avoiding confusions in looking for what is simply named a universalistic system.

In order to distinguish the variety of mixed systems we have to consider several features. First, are relevant the criteria according to which the general practitioner (the agent who makes the order of purchasing the service) is assigned to each household. Then, it is meaningful the individual degree of choice of the provider by which to obtain health care services, as diagnostics and specialist treatments and hospital admissions. In this respect, there are systems allowing a high individual freedom of choice and other ones with a rigid assignment by public administration, but, of course, there are several

⁴ For *Census Bureau* about 46 millions of American citizens are not assured for illness risks. They are mostly less than 65 years old individuals and with a average income, so they are not covered by either *Medicare* or *Medicaid*.

⁵ First, Obama's reform introduces some measures for protecting the insured individuals, or enrolled at a *Medicare* or *Medicaid*, against rent seeking behaviours of insurance companies, like forbidding both *cream skimming* and the rule of fixing a maximum amount of care, while foreseeing a limit for *out-of-pocket* expenditure. Second, the reform tends to create a publicly regulated market, where several insurance companies competitively supply bundles of homogeneous services, according to some common rules. Further, all the American citizens will be obliged to buy a health insurance, consequently individuals or firms unable to pay for the premiums will receive adequate tax allowances and benefits. This "*new insurance exchange model*" will be financed by general taxation and the expected efficiency gains from a higher competition respect to current situation where local insurance monopolies prevail in many states.

intermediate situations. Another relevant distinction refers to the ways of paying the providers, i.e. if it is allowed an ex-post coverage of the production costs, or it is fixed an ex-ante budget, or it is organized a system of prospective standardised tariffs for each treatment. Further, the mixed systems may be differentiated according to the forms of organizing the supply of drugs and to the ways their prices are established, and the co-payments and coinsurance rates structure is designed.

According to these criteria, the literature in health economics usually distinguishes three specific types of mixed systems. The first one is known as the *reimbursement model*, where insurance companies or decentralised health districts (or regional governments) reimburse the patients expenditures, after they have paid, at administered prices, the services to public as well private providers. The second system is the *integrated model*, where the health district builds up with the providers a unique connected public structure. The patients do not pay for the treatments which are financed by taxes, but they have a limited or no choice where to receive them. The internal hospitals and clinics are financed at costs of inputs or, sometimes, with reference to a fixed budget. Finally there is the *contractual model* where the funding body, the insurer or the health district, is separated from the providers which, whether public or private ones, are committed and rewarded according to a procurement contract. This is based on prices that in most cases are fixed ex-ante and standardised along the system of Diagnostic related groups (DRG). Consumers-patients generally have, according to the variety of contractual systems, freedom of choice of the provider and the general practitioner they desire to engage. Quasi-markets (QM) are a specific typology of the third model, often called managed or internal competition, organised in the last decades in some European countries (section 3.3.).

3. Industrial organization and institutional design of health care

3.1 The Cost-Benefit of vertical separation (integration) in health care industry

The vertical separation of purchasing structures from producing and supplying ones is a necessary but not sufficient condition for creating competition in health care industry. Thus, this institutional design issue must be treated *per se*, by looking at cost-benefit of vertical integration in terms of production costs level, economies of scale and scope, network and coordination economies. Within this context, health economics can well consider the pros and cons of different organizational systems. Indeed, the transactions between a buyer, e.g. a health district, and seller, e.g. a hospital, can be realized by a market contractual exchange (in case of separation) or by a internal transfer within a unitary body (in case of integration). Therefore, for modelling the determinants of this

choice, we have to consider the alternative between hierarchy and market, by comparing the administrative costs of managing a complex structure (the *firm*), with the costs for signing incomplete contracts with the providers (the *market*)⁶. Further, a variety of industrial issues matter, like the degree of complementarity of the purchasing and production assets, the *rent-seeking* behaviours of the several agents, those making the choice and those applying it for the relevant activities, the existence of sunk costs and irreversible investments and the consequent hold-up issue. Of course, are also relevant all the transaction costs concerns, as the contractual size and complexity, and the time and costs requested for settling the eventual controversies on trial (Williamson 2005). Thus the integration will be preferable to a system based on market exchanges and transactions when its advantages, by limiting the opportunistic behaviours and ex-ante and ex-post contract inefficiency, are higher than the static and dynamic inefficiencies due to huge bureaucratic centralised structures, typical of public administration. In Fig. 2 we synthetically sketch the main institutional alternatives.

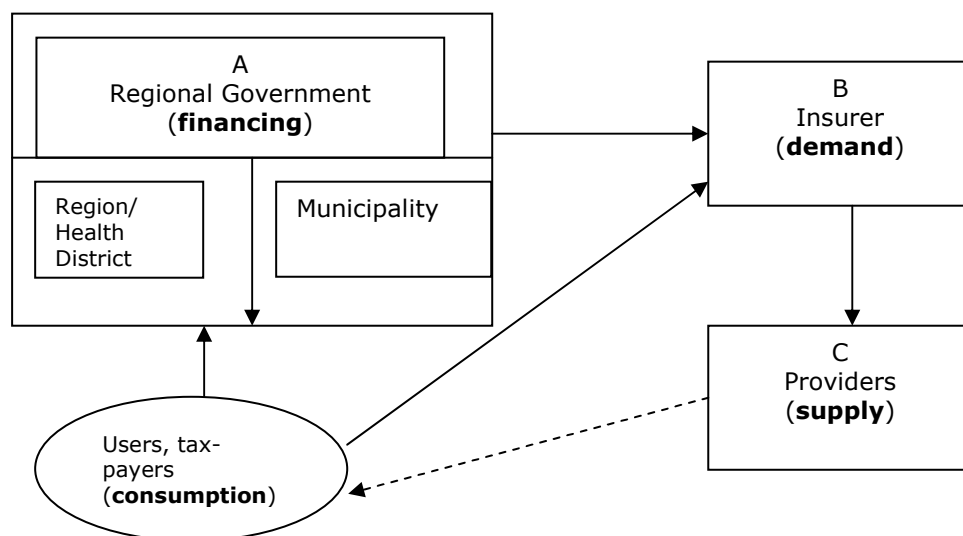


Fig. 2. Funding (bold arrows) and service provision (dotted arrow) flows with integration or separation in health care organization
 (A+B+C): integrated model;
 (A+B)=>C: semi-integrated model;
 A=>B=>C: separated QM model

In a *de-integrated (separated) model* (A=>B=>C), as the Dutch one, there is a limited degree of industrial concentration. The tasks of expressing, on the behalf of patients, the demand and of establishing the appropriateness of services and treatments are delegated to a specific Authority, a public Sponsor of citizens. The providers are public or non-profit institutions, but they must be, in any case, appropriately ex-ante selected and declared as "reliable providers". The selection procedure aims at controlling

⁶ For general surveys of this topic see Gibbons (2005), Bolton and Dewatripont (2005, ch. 10).

and limiting the provider power in the negotiation due to asymmetric information and at assuring that the several and usual situations of necessity and urgency of users are resolved. In a *public-public integrated model* (A+B+C), like that one prevailing in some European regimes, there is a strong industrial integration, that, in the polar version, unifies in a whole structure, a "Local health firm", as the ASL in Italy, all the functions of planning, demand rationing, financing, production and supply of services. In milder versions of the model ((A+B)=>C), some hospital firms (AO) may be separated from the ASL, still remaining publicly owned. This *semi-integrated* configuration is wholly working in U.K, where there are a *Health District Authority* (HD) separated from the *Trust hospitals* (TH), the patients can choose as favourite.

The main objective of the integration is to improve the capacity of coordination by the planner, by limiting the conflicting interests among the involved agents, while this conflict is considered beneficial by the advocates of the de-integrated model. Further, the integrated model is aimed at limiting the opportunistic manipulation of demand, which is often not objectively determinable, mainly on the social-assistance components. However, the integrated model has all the shortcomings and defects of the centralised and complex structures, at high level of bureaucratization and high administrative costs (Dixit 2002), and it suffers the politicians interference, in all the ways it can occur. Moreover, the model does not give adequate incentives toward the internal efficiency of the institutions (Le Grand 2003, 2007), whose lack becomes the main cause, together with the so called "soft budget constraint syndrome", of the wide sunk deficits of the decentralised bodies (Rodden et al. 2001, Wildasin 2004). Consequently, on looking at the *cost-benefit* of separation vs. integration, considerations of *Political economy* should be taken into account. The application of new *Political economy* models (Besley 2007) to health economics allow to contemplate the behaviours and the conflicting relationships among citizens and politicians, the public providers and the interests groups, as the pharmaceutical industry and doctors profession (Zweifel et al. 2009, ch. 13).

In conclusion, we may try to summarize the *pros and con* of institutional design based on the separation as follows.

Table 2 **Pros and cons of the separation of structures**

Benefits	Costs
positive incentives from the interests conflict matching the demand by a ASL (HD) and the supply by the providers, as a AO (TH)	a limited exploitation of economies of scale and scope (no gains from increasing returns and complementarities in cost structure)
positive incentives from competition-quality-choice conduct arising from purchasing contracts	high transaction costs for signing and implementing highly incomplete contracts
more transparent accountancy procedures and better performance measurement	lack of whole corporate view of the three management functions and consequently difficulty to effectively control demand and

	supply
more management specialization on the three main functions and responsibilities: <ul style="list-style-type: none"> • <i>Insurance</i> (risk and need perception) • <i>Production</i> (measurement and control of costs and returns), • <i>Purchasing</i> (demand input controls) 	phenomena of demand induction from providers mainly boosted to increase the revenues
Controls of costs and quality by Health Authority, acting as "aware bidder contractors" and not as a "blind purchasers"	

3.3. Separation plus competition: the quasi-markets

A clear separation of structures, of the kind A=>B=>C, opens the scope for applying Quasi-markets (QM) which are, as said, a specific advanced typology of the contractual model⁷. The features and the cost-benefit of such a model may be summarized as follows.

Table 3 **Managed competition and Quasi-markets in health care**

Advantages	Disadvantages
limiting the productive role of the state, which could better specialize its effort working only as purchaser of services, on the behalf of the citizens enrolled in the NHS	possibly boosting <i>cream-skimming</i> procedures by providers
enhancing a beneficial competition among providers (mainly public ones). It is a <i>monopolistic competition</i> on the quality, as the prices of treatments are generally fixed	requiring complex ex-ante and ex-post performance controls by a public body, or a specific Authority, able also to properly regulate the internal market with plans and hard budgets, efficient bidding and contractual activities
pushing up the <i>voice</i> of patients-consumers through the role of sponsor played by the insurers	enhancing, contrary to what expected, both private and public health expenditure, owing to phenomena of moral hazard and of inducing distorted demand by highly competitive providers, engaged to acquire as many customers as possible
allowing the <i>exit</i> of patients-consumers, giving them the freedom of choosing the preferred provider	lack of incentive to efficiency if, in some areas, competition among hospitals is simply not possible, so local monopolies actually arise (<i>industrial configuration failure</i>)
boosting cost-containing and quality enhancing actions	together with the incentive to increase observable features of quality, there may be the incentive to decrease the not observable ones ⁸
boosting R&D activities in medical industries, as	freedom of choice is somewhat misleading

⁷ See Maynard (1994) and Jones e Cullies (1996) for two formal analyses of the working of an emblematic QM, like the English one during Margaret Thatcher's era. For a systematic evaluation of the to day NHS, after Tony Blair partial revisions of the latter, see the OCDE Report by Smith e Goddard (2009).

⁸ Propper et al. (2008) have shown that Trust hospitals competition in NHS, although has reduced average waiting lists (observable feature), has increased other non observables relevant features of quality, like death rates.

the hospitals, being "residual claimant", can reinvest the "profits"	given the imperfect information of patients and the potentially non-benevolent pay-off and behaviour of the physician prescribing the treatments.
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From Table 3, it turns out that managed competition may be socially desirable in some institutional and economic contexts but in other ones it actually does not work. Indeed, only a limited group of European countries have pushed their reforms in health care systems toward a pure contractual-QM model. We may say that in the Netherlands, U.K., Germany, Sweden now are prevailing, after several succeeding reforms in the nineties, quasi-markets organized, to a large extent, in potentially pro-competitive systems. In countries like Spain and Italy there are instead systems with only some elements of managed competition as, although they have intended to introduce internal competition features, have actually given up to fully apply them, recognizing and emphasizing their limits. Further there are countries, like France, Denmark, Finland, that, even if aware of the defects of the purely planned systems in terms of incentive to efficiency, have considered only very few or no pro-competitive items⁹.

3.4 Tariffs for health services and incentives in separated and semi-integrated models

In $(A \Rightarrow B \Rightarrow C)$, but also in $((A+B) \Rightarrow C)$, models it is relevant to consider the different techniques for rewarding the provider¹⁰, as these imply different incentives for cost-containing and quality-enhancing (Ma 1994). A simple analytic representation may enlighten these features. Let a tariff for a hospital treatment be given by this linear function:

$$T = a + b C(q, e, \mu); \quad 0 \leq b \leq 1 \quad (13)$$

where $C(\cdot)$ is the production cost of the volume of treatments q ; $C_q \equiv \frac{\partial C}{\partial q} > 0$ is the

marginal cost. $e \in [e_{\min}, e_{\max}]$ is the cost-containment effort carried on by the hospital

manager and $C_e \equiv \frac{\partial C}{\partial e} < 0$ its marginal effect on the level of cost, with $\frac{\partial |C_e|}{\partial e} < 0$, for

regulatory concerns. $\mu \in [\mu_{\min}, \mu_{\max}]$ represents the quality of the treatment and

$C_\mu \equiv \frac{\partial C}{\partial \mu} > 0$ its marginal cost, positive as clearly higher quality requires more resources,

⁹ Notice as the model may even change among regions or states of a federal country, with decentralised health care, as we may say it happens in Italy, where in Lombardy there is a QM system and in Tuscany a somewhat command & control system.

¹⁰ The topic has been analysed by a large and complex literature, surveyed, among others by Chalkley and Malcomson (2000), Dranove and Satterwaite (2000), Boadway et al. (2004) and Zweifel et al. (2009, ch. 10).

with now $\frac{\partial C_\mu}{\partial \mu} > 0$. Let us suppose that a HD or a ASL plan establishes a given volume of service output to be provided, so $q=q^*$ is inserted in the contract signed with the hospital (TH or AO). Both e and μ are instead not observable by the HD and then are not contractible, while production costs of the TH are only ex-post observable, i.e. when realised. Let then define with $\psi(e,\mu)$ the objective function of the manager of the hospital, where $\psi_e \equiv \frac{\partial \psi}{\partial e} < 0$ represents the marginal cost of cost-containment effort (disutility), with $\frac{\partial |\psi_e|}{\partial e} > 0$, and $\psi_\mu \equiv \frac{\partial \psi}{\partial \mu} > 0$ the marginal benefit of quality in terms of prestige and reputation of the manager, with $\frac{\partial \psi_\mu}{\partial \mu} < 0$.

In a separated or semi-integrated system, a *residual claimant* provider will tend to choose e and μ to maximize the following difference function:

$$R=T-C(q^*,e,\mu)-\psi(e,\mu) = a-(1-b) C(q^*,e,\mu) +\psi(e,\mu) \quad (14)$$

In the case of a fee-for-service tariff (*cost-plus contract*), as in both reimbursement and integrated models, we have $b=1$. Therefore, it is

$$T=a+C(q^*,e,\mu) \text{ and } R=a+\psi(e,\mu)$$

i.e. the residual is independent on production costs, so there is no incentive to contain them. Indeed, theoretically, the optimal level of the hospital manager effort is a corner solution such that $e^*|_{b=1} = e_{\min}$. However, being fully insured, the manager does not exploit the informative monopoly and might give up cream-skimming procedures and provide high quality treatments. Therefore, it might well happen a further corner solution such that $\mu^*|_{b=1} = \mu_{\max}$.

In the case of a fixed per treatment tariff (*fixed-price contract*), i.e. $b=0$, as in pure QM contractual model, where there is a prospective DRG payment, it is

$$T=a \text{ and } R=a-C(q^*,e,\mu)+\psi(e,\mu).$$

Since the residual is now decreasing with the treatment production cost, the hospital has an effective incentive to contain it. The optimal level of the effort is given by the condition $|C_e| = |\psi_e|$ implying that $e^*|_{b=0} > e^*|_{b=1} = e_{\min}$. However the hospital, bearing the full firm risk, may be induced to cream-skim high illness risks and to restrain the quality level of the service; indeed, in this case, the optimal quality level is given by condition

$C_{\mu} = \psi_{\mu}$, and $\mu^*|_{b=0} < \mu^*|_{b=1} = \mu_{\max}$. In more concrete terms, a fixed-price contract, without a reliable ex-ante selection of providers and effective controls on standards, may entail a worsening of treatment quality, with for instance a higher rate of patients mortality.

This simple model seems to suggest that, in order to reach an adequate standard of quality but satisfying a fixed budget constraint, a mixed systems of *cost and risk-sharing* payment, with $0 < b < 1$, might be preferable. The optimal levels e^0 and μ^0 are now given by the conditions $(1-b)|C_e| = |\psi_e|$ and $(1-b)C_{\mu} = \psi_{\mu}$, according to which it obtains $e^*|_{b=0} > e^0 > e^*|_{b=1} = e_{\min}$ and $\mu^*|_{b=0} < \mu^0 < \mu^*|_{b=1} = \mu_{\max}$.

Actually, a incentive risk-sharing criterion may be pursued by organising a system of budgeted plans based on a fixed volume of treatments, some proxy indexes of quality, and standardised and verifiable costs, with ex-post revenues abatements in presence of non-fulfilments of the objectives.

3.5. Ownership structures and investment task assignments in the hospitals

The trade-off between cost-containment and quality can influence also the institutional design and the ownership options for health structures. As regard, particularly meaningful are recent extensions of the theory of property rights with incomplete contracts, treating the issue of delegation of responsibility on assets running, according to the incentives by private as well public managers to productive efficiency and quality of services (Hart 2003, Sadka 2007). The segmentation of a public firm in different branches, with out-sourcing of some purchasing and selling activities, e.g. the separation of hospitals from the public health authorities, could be justified in terms of the assignment of investment tasks, i.e. the convenience of transferring the responsibility for certain elements of the treatments to private hands, while maintaining other elements in public hands.

Hoppe and Schmitz (2010) have recently developed a model where contracts on the privatization of infrastructures projects, like new hospitals, do not only specify the transfer of ownership rights, but also assign the responsibility, regarding design construction, maintenance and modernization of the structure itself. Thus they consider a set of combinations public vs. private activities which appear very promising for analysing health care industrial organization. Let take into account a situation where, at date 0, the government (G), in our case a health district (HD), and a manager (M) of a hospital write a contract that specifies a volume q of treatments, with features described ex-ante, and a payment T from G to M. When the manager provides the treatments he incur costs qC_0 , while the health district's benefit is given by qB_0 , where $B_0 > C_0$. The parties also agree on an ownership structure and an investment task assignment.

The *ownership structure* $o \in \{M, G, J, N\}$ determines who is in control of the hospital assets and equipments. Under private ownership ($o=M$), the manager has the right to modify the assets in order to implement innovations that may improve quality or reduce the production cost, enhancing x-efficiency. Under public ownership ($o=G$), the HD controls the essential infrastructures. There are also two kinds of partnerships. Under $o=J$, both parties have veto power, so that no one can implement any innovations without the partner's consent, while, under $o=N$, each party has the right to modify the assets to implement innovations. The *task assignment* $A \in \{M, G, MG, GM\}$ determines who is in charge of the two types of non-contractible investments, for reducing costs of providing treatments and enhancing quality, that can be made at date 1. The first type of innovation reduces the manager cost per unit, but at the same time it also lowers the quality and thus reduce the government's benefit. The second type of investment results in a innovation that improves the treatment's quality, so that the HD's benefit per unit increase, but also increases of the hospital's cost per unit. The assignment $A=MG$ (resp. $A=GM$) means that the hospital manager (resp. the HD) is in charge of cost-containment investment task and the government (resp. the manager) is responsible for quality-enhancing investment task. The party in charge bears the associated investment costs. Finally, at date 2, the parties may renegotiate the quantity of the treatment to be provided, the decisions whether or not to implement the innovations, and the payment. The negotiations are modelled as Nash bargaining solutions, according to which the renegotiation surplus is divided between the parties.

Let us concentrate on Hoppe and Schmitz propositions on the cost-benefit of ownership structure and tax assignment, leaving aside the propositions regarding the volume of treatments, and let consider the case $o=G$, where the ownership of the hospital is public one (Proposition 5ii). This case emerges as optimal when the negative side effect of the quality innovation is negligible. It is shown that, if M has a larger bargaining power than G, the preferred task assignment is $A=MG$, then M should be responsible for the cost investment and G for the quality investment. While, if G has a larger bargaining power than M, the preferred task assignment is $A=G$, then G should be responsible for both investments. Further Hoppe and Schmitz (Proposition 6) show that a partnership with no veto power ($o=N$) can be optimal only if the parties' bargaining strengths do not become too asymmetric. When one party's bargaining power becomes large it becomes impossible to find the quantity of production that balances the incentives for making both types of investments.

Consequently their approach suggests that:

(i) partnerships between the public and the private sector in running a hospital should be carried out when the bargaining power is relatively balanced and if the side effects of cost and quality innovations are relatively unimportant;

(ii) public (private) ownership should prevail if the side effects of cost (quality) innovations are strong.

In this respect, it is worth to notice that the private bargaining power is inversely related to the degree of competition among hospitals. However, the government's bargaining power is likely to be weak ex-post since finding an alternative suppliers, during the renegotiation, is usually difficult. Moreover, it is empirically proved that the effect on hospital production costs of improving quality of treatments is quite high, given the needed sophisticate equipments. While, if the hospital is far from x-efficiency, a innovation reducing costs could imply low side effects on quality.

4. Insurance and funding health systems for public and private spending

4.1 Health insurance framework for funding systems

We may say that the logic of insurance applies more or less to all health care funding systems, also to the strictly public ones. Indeed, the cost of a treatment is, in any case, a risky event whose coverage should be guaranteed to risk averse individuals. Therefore, the financing systems may be distinguished according to the way the three main players in the big health care game - the *patient*, the *provider* and a *regulating entity*¹¹ - interact each other. Thus, after the distinction based on the degree of integration between such institutions, considered in the previous section, a second significant distinction comes from the way the patients (and the tax-payers) finance the institution/insurer (see the flows on the left part of Fig.2). More specifically, we may distinguish as follows:

Table 4 **Funding health care expenditure**

<i>Instruments</i>	<i>Insurance systems</i>
Insurance premiums based on individuals risk and administrative costs	voluntary private insurance policies
Community rating insurance (CRI), based on average risk	Compulsory public insurance
Health contributes (payroll-taxes) burdened by employees and employers	compulsory social insurance by categorical funds of non-profit enterprises
General taxes specifically devoted to health care spending	standard National Health Service (NHS)

It is clear that the pure insurance mechanism is running only in case of voluntary private insurance, where each policy breaks even and premiums are "fair". In case of insurance with CRI an explicit cross-subsidization from low risks to high risks is at work. In the other cases subsidization is still present, although not explicitly. In the third one,

¹¹ This is often called the *Medical care triad*, see Cutler and Zeckhauser 2000.

in fact, the premium is arranged as a fraction of labour income, possibly with upper limits to the payment. Thus, as the risk of sickness is inversely correlated to the labour productivity (skill) and then to the income, also in this case, low risks tend to subsidize in the average the high risks. In the last case, the NHS, the insurance mechanism is of course quite mild, but actually it remains in aggregative terms. Indeed, the amount of resources coming from taxation and devoted to funding health care must cover ex-ante the aggregate value of insured risks, measured by the *Essential levels of Health Care* (ELC). However, in this case, the logic of insurance is inevitably violated if, removing such a constraint, the deficits are ex-post always bailed-out by the government.

In case of funding the insurance coverage by general taxation, arise some trade-offs between redistributive and insurance aims. In particular, being risks, as said, inversely correlated to income, the social coverage rate may reach redistribution objectives, helping the parallel role by progressive taxation, indeed moderating its distortion effects (Rochet 1991, Cremer and Pestieau 1996)¹². We are going to specifically analyse this issue in the following sub-section.

In OECD countries we may find many different health care financing systems. A syntheses might run as follows (OECD 2009).

Table 5 Financing systems of health care in OECD countries

NHS supported by general taxation (models à la <i>Beveridge</i>)	Australia, Canada, Denmark, Finland, Iceland, Ireland, Italy, New Zealand, Norway, Portugal Spain, Sweden, U.K.
Social insurance systems financed by mandatory payroll contributes to Social Insurance Funds (models à la <i>Bismark</i>)	Austria, Belgium, France, Germany, Hungary, Japan, Luxembourg, The Netherlands (before 2006 reform), Poland
Systems of private insurance, although compulsory, financed by CRI	Switzerland, The Netherlands (after 2006 reform)
Mixed social systems, as a combination of the three previous cases	South Korea, Greece, Turkish, Slovakia, Czech Republic
Systems with prevailing voluntary private insurance	U.S.A., with <i>Medicaid e Medicare</i>
Mixed private systems financed by direct payments by patients	Mexico

Actually, in the groups of European welfare tradition countries, mixed systems are prevailing. In the first group, the Beveridgian NHSs, beside general taxation there are also social contributions or scope taxes on wages. This happens in U.K. but also in Italy. In the Bismarkian social insurance systems of the second and third group, the insurance funds are frequently integrated with resources from taxation system. U.S.A and Mexico systems are somewhat outliers. Quite interesting is the cross analysis of separation issue

¹² For a analyses of European reforms in terms of integration or separation between redistribution and insurance aims see Breyer and Haufler (2000).

and funding issue to understand the complexity of health care systems. For instance, the U.K. NHS, though funded by general taxation, is characterized by an internal market with high industrial de-integration and large freedom of choice by patients (Smith and Goddard 2009), while, in the classical U.S private insurance system are working the *Health Maintenance Organizations* which follow a integrated model of industrial organization.

Several European countries have a health care funding system structured in two or three "pillars", but with meaningful differences in the size of each one (Mossialos and Thomson 2004, Zanette and Ricatti 2006, Gechert 2009). A first pillar is devoted to socially cover a uniform basic package of services (ELC) and a second one is devoted to a private integrative insurance for the remaining services. The solution toward a partial social coverage in most NHSs is signalled by the several forms of rationing publicly provided services and treatments, according to their "appropriateness" and cost-effectiveness. The pillars may be three when a second pillar can be inserted within the previous two ones, with publicly regulated capitalization health funds. This second insurance setting, mainly organised by public municipalities and regions through "reliable" companies, plays the fundamental role of limiting the size of the purely private health spending remaining in the third pillar. The second pillar may refer to *supplementary insurance*, when it provides a double coverage to services in the statutory package. It could be the case to offer a perceived quality advantage over the care secured by the statutory package, e.g. in the form of reducing waiting times or access to superior facilities. The integrative insurance may be also *complementary* when offers full or partial cover for services excluded or not fully covered by the statutory package, like Long Term Care expenditures (in Germany), and for covering the liability for co-payments levied on ELC services (in France).

4.2. *On the theoretical foundation of a multi-pillar funding system*

The rationale and the features of these mixed systems have been widely investigated by theoretical health economics, following two streams of literature. The first one straight considers the social convenience of a public community rating insurance plus a supplementary private insurance. The second one, surveyed in the following sub-section, analyses the more complex and more realistic case of three-pillar systems with distortionary income taxation financing the social component.

We may say that the topic has been originally introduced in the theory of health insurance by Wilson (1977) seminal contribution. Wilson moves from a classical adverse selection *Rothschild-Stiglitz separating equilibrium* (RSSE), where, since the low risks are rationed, there may be scope for Pareto-improvements. The main result is that an improvement can be achieved by introducing compulsory insurance coverage. Wilson has

modelled a health system where there is a mandatory public policy, just breaking even because lying in the pooling line pertinent to the population at large, and individuals are allowed to buy supplementary health insurance. Given this framework, it turns out that the pair of contracts (compulsory plus voluntary part) Pareto-dominates the RSSE without social insurance¹³. As shown also by Dahlby (1981), the new mixed equilibrium gives a full (partial) coverage insurance to high (low)-risks, as in RSSE, but now both contracts are preferred to the previous ones. The high-risk types benefit from cross-subsidization within the public insurance contract, while low-risks types are better off given the relaxation of the rationing restriction, allowing an increased overall coverage as compared to the absence of mandatory public insurance with partial coverage. This mixed two-pillar solution is even Pareto-superior to a one-pillar public insurance with a uniform community rating for all individual. In fact, by allowing an appropriate risk-selection, it reduces the effect of the tax burden to low-risks which have to pay for their insurance and for cross-subsidizing high-risks.

Hansen and Keiding (2002) extend Wilson-Dahlby approach by providing a welfare comparison between three alternative health insurance regimes: (i) a unregulated voluntary market regime, where consumers either buy full coverage or no coverage; (ii) a compulsory and uniform universal regime with community rating; (iii) a compulsory, universal community-rated regime that allows private supplementary insurance. The novelties of their analysis are twofold: first, in order to make the welfare comparison between the community-rated insurance (CRI) regime and the voluntary private insurance one, they derive the level of the compulsory insurance as the equilibrium choice in a median voter model of political economy. Second, they base their comparison on either the Hicksian compensation principle (where the winners could compensate the losers), or a utilitarian average utility concept. These welfare criteria appear to be more meaningful than the simple Pareto-criterion, considered by Wilson-Dahlby approach, since compulsory insurance regimes are likely to make low risks worse off, assuming that the level of mandatory coverage regimes exceed the level that would be chosen voluntarily by low risks. Hansen and Keiding show that their voluntary full coverage reaches a higher average utility than the compulsory insurance determined by the median voter, under plausible hypotheses on the distribution of risks. Low risks are better off under the compulsory insurance status because they purchase insurance at reasonable cost, while they remain uninsured in the voluntary setting. High risks, instead, are worse off with compulsory coverage because they have less coverage than they would choose to buy in the voluntary market equilibrium, but this drawback is reduced if they can purchase risk-rated supplementary coverage. Hence it is welfare improving to permit supplementation to a compulsory CRI scheme.

¹³ See the elegant graphical analysis in Zweifel et al (2009, p. 177).

However, this result is not fully robust: changing slightly the context, we may reach different outcomes. Kifmann (2002), for instance, shows that if insurers that offer the basic CRI benefits are allowed also to offer the supplementary ones, the regime can only benefit low risks at the expense of high risks. The finding depends on Kifmann's assumption that the community-rated insurers offer supplementary benefits that disproportionately attract low risks. Consequently a separating equilibrium is reached where the high risks buy the basic package from community-rated insurers, while the low risks buy the supplementary coverage from other insurers. This has the effect of reducing the transfer from low to high risks, as desired by the government, and leads the low risks to consume benefits worth less than their cost, because they avoid the cross-subsidy to high risks. This result seems more plausible if the supplementary package covers specific services that only appeal to relatively healthy individuals.

Danzon (2002), by commenting, in a special issue of *Journal of Health Economics*, the contributions by Hansen and Keiding and Kifmann, concludes that "...the welfare effects of permitting supplementation of compulsory, community-rated insurance depend critically on who buys the supplementary coverage and how the supplementation affects the rating of the basic coverage. Supplementary coverage is more likely to be welfare improving if it is bought primarily by high risks, for whom the basic coverage is presumably suboptimal. This result is more likely if the supplementary benefit is offered by separate insurers".

Different insurance regimes have impacts not only in terms of efficiency but also in terms of wealth vertical redistribution. In this respect, Leach (2010), from a pure redistributive perspective given by a social aversion to the inequality¹⁴, looks for the optimal a health care system among a fully private insurance, a fully public (social) insurance and a mixed insurance (public insurance with a supplementary private one). By comparing the first two extreme solutions, the author shows that with the optimal public health care system, people who are relatively unhealthy, with and without treatment, receive more health care, and people who are relatively healthy, with and without treatment, receive less health care. However, the aggregate quantity of health care under the optimal public regime might be either greater or less than under private one. When there is a mixed system, with both public and private insurance, the latter covering treatment for types that are not covered by the former, it may happen that, in an equality-averse society, the role of private insurance is almost negligible. The parallel system of private health insurance tends in fact to reduce welfare with respect to an optimally designed entirely public system.

¹⁴ There is a strictly concave ex post social welfare function over agents who are ex-ante identical, differing ex-post in the state of their health.

The first stream of literature is, other than fairly inconclusive, not completely satisfactory in modelling a multi-pillar system. Even if we derive, as in Hansen and Keiding (2002), a social preference for a mixed system, where a public compulsory insurance, covering a package of essentials, is integrated by a private policy topping up the remaining services, we have no indication on the optimal composition of the total insurance, i.e. the number and the size of the pillars. The most convincing analyses for analysing multi-pillar health insurance systems come from contributions modelling the social insurance in the first pillar as a redistribution device financed by a distortional income tax¹⁵. This kind of model reflects the phenomenon of frequent interaction between social and private insurance now characterizing many sectors of welfare states in industrialised countries (Chetty and Saez 2010).

4.3 Three-pillar system with optimal income taxation

Blomqvist and Johansson (1997) and Selden (1997) considered a multi-pillar public/private health insurance system, but without an income-dependent contribution to social insurance with a variable labour supply. Petretto (1999) extends the two contributions in this way. He models a NHS with a supplementary private insurance, but where low-risk or rich people are not allowed to opt-out of the NHS. Thus a three-pillar system is modelled so that the health services purchase by an individual is matched by three funding components: the social insurance, the supplementary private insurance policy and the out-of-pocket expenditure. The social insurance is financed by a linear income tax, whose structure is optimally chosen, together with the social insurance coverage, by the government. This faces n types of individuals distinguished by two parameters, the probability of illness and skills (wage in efficiency units). There is ex post moral hazard with regard to health expenditure and adverse selection from the government perspective, as it can not observe individual's skill parameter. Moreover, although the probabilities of illness are however known, the government cannot differentiate its tax policy between high-risk and low-risk individuals, but only according to their personal incomes.

In this framework, the individual's equilibrium private coinsurance rate follows the standard condition of optimal insurance with ex post moral hazard. This requires, as in condition (4) in section 2, to equalising, at the margin, the *gain of risk-sharing* with the deadweight loss due to *moral hazard effect* for each individual. The private insurance contract, signed by individual i , includes a coinsurance rate $k_i(\cdot)$, which is a "reaction function" of social policy instruments, i.e. the payroll tax rate t and the social insurance

¹⁵ As said, in the previous sub-section, this issue has been firstly analysed by Rochet (1991) and Cremer and Pestieau (1996), but without investigating a multi-pillar setting.

rate, α . Thus $P_i=(1-\alpha)k_i(\alpha,t)$ may be considered as the individual i "unit price" for health expenditure E_i or his unit cost of the service out-of-pocket consumption. Thus with $\frac{\partial P_i}{\partial \alpha} = -k_i(\alpha,t) + (1-\alpha)\frac{\partial k_i}{\partial \alpha}$ we measure the change of this price due to social insurance, which is negative for a sufficiently inelastic reaction of private insurance to its social counterpart (crowding-out effect).

As far as the optimal social insurance rate α^* is concerned, this is given by equalizing the sum of two marginal social benefits (the l.h.s) with a marginal social cost (the r.h.s) as follows (Petretto (1999, formula (19 and 20))¹⁶:

$$SRSG+SRG=SMHC \quad (15)$$

where

$$SRSG = \sum_i Cov_p(\bar{b}_i, -\frac{\partial P_i}{\partial \alpha_i} E_i)$$

$$SRG = n[\bar{b} \xi_E - 1]\bar{E}$$

$$SMHC = (1-\alpha)\sum_i \bar{b}_i(1-k_i)\frac{\partial \bar{E}_i}{\partial \alpha} + \alpha n \frac{\partial \bar{E}}{\partial \alpha}$$

On the l.h.s., $SRGS$ represents the social-risk sharing gain from a marginal increase of social insurance coverage, α , and is given by a measure of the benefit for the whole society from "buying" a further insurance policy with uniform reimbursement rate for all members. α is higher, the higher is the sum of individuals' gains of risk sharing, referring to out-of-pocket health spending. The gain from risk-pooling is somewhat socialised in two ways: first, by following a utilitarian welfare function rule, i.e. summing up the individual covariances between marginal utility of income and out-of-pocket health expenditure; second, by considering, as in the classical optimal taxation framework, each individual's "social" (i.e. measured in terms of government revenue) expected marginal utility of income, \bar{b}_i . The term SRG represents the social redistribution gain stressing the role of α^* for vertical equity aims. The higher is the *distributional characteristics* (à la Feldstein) of health spending, $\xi_E = Cov(\bar{b}_i, \bar{E}_i)$, the higher is the optimal rate α^* , as in the standard model of many-consumers optimal commodity taxation, with a linear income tax. Indeed social insurance coverage works like a subsidy applied to health expenditure at a uniform rate. On the r.h.s., $SMHC$ represents a social moral hazard cost as a weighted sum of two individual's moral hazard effects: the first comes from private budget constraints and it is linked to the sum of individual effects in terms of expected

¹⁶ The terms with "bar" are expected values and the terms not identified with i are average values in the population.

health expenditure increase; the second is determined by government budget constraint and is related to the effect on total public expenditure due to social health insurance.

Boadway et al. (2006) extend Petretto (1999) by adding adverse selection on the distribution of risks to ex-post moral hazard. In their model, private insurers are well informed about households productivity so can offer separate insurance policies to persons of different income classes. But, since risk class cannot be observed, insurance policies must be designated to separate high risk from low-risk persons, as in *Rothschild-Stiglitz model*. In other words, within each productivity class, there is an insurance market equilibrium separating the two risk subclasses where insurers offer policies (premium and coverage) for L (low-risk) and H (high-risk) households of productivity class i , choosing their most preferred policy. Insurance companies are then better informed than government, which can observe neither risk class nor productivity. This gives an advantage to private insurers thereby making the case for social insurance as strong as possible.

The most plausible circumstances contemplated by the model actually design situations where there is room for private insurance (the second pillar), given the presence of partial social insurance (the first pillar). Neither high-risk persons or low-risk persons have full insurance given ex-post moral hazard and then, as in Petretto (1999), there is an out-of-pocket component of health expenditure (the third pillar). As far as the choice of the optimal social coverage rate, Boadway et al. find an expression extending in many respects condition (15) by Petretto. Given the adverse selection context, it is analogous to the standard expression for linear income tax rate, combining equity and efficiency concerns, except that it includes additional terms reflecting the various margins of distortion of the economy. Boadway et al. (2006, formula (12-17)) are in fact able to explicit α^* as follows:

$$\alpha^* = \frac{[Eq] + [LD] + [AS]}{[MH]} \quad (16)$$

where $[Eq]$ is an equity concern term, given by the covariance over all types between the marginal expected social valuation of income and health care spending, $[LD]$ a efficiency concern term for the indirect effect of social insurance on labour supply distortion, $[AS]$ an adverse selection term for fulfilling self-selection constraints, and $[MH]$ is moral hazard term, linked to the compensated total change in the demand for health care spending w.r.t. α .

As in Petretto (1999), at the optimum of a three stages game, for plausible hypotheses, a interior solution arises, such that $0 < \alpha^* < 1$. This result implies that, for designing a mixed insurance system, a uniform social insurance rate is justified on the basis of equity as well efficiency considerations. Therefore, the first pillar, although essential and probably with a significant size, in general, does not guarantee a full social

coverage: some services must be rationed, looking at their “appropriateness”, and further expenditures must be financed with supplementary insurance and co-payment (out-of-pocket).

Table 6 summarises the logic of mixed insurance system, by representing the sequential decision-making structure implying three pillars, to be solved by backward induction.

Table 6 The three-stage, three-pillar, game with asymmetric information

Stage 1. Optimal social insurance rate, $0 < a^* < 1$ and optimal income tax rate t^* , with a trade-off equity-efficiency
Stage 2. Supplementary insurance, given a and t , with optimal coinsurance rate
Stage 3. Out-of-pocket expenditure (co-payment), given the two insurances

4.4 Toward a general theory of optimal taxation with endogenous private insurance

The logic of multi-pillar funding may be extended to the more general issue of looking for the optimal amount of redistribution taxation and social insurance. Chetty and Saez (2010) has recently developed a quite general model, with moral hazard and adverse selection, where social and private insurance, in terms of linear contracts based on individual income, interact each other. They extend Petretto (1999), by considering several combinations of optimal tax rates, and Boadawy et al. (2006) as well, by admitting private and public insurers to have the same informational constraints, being in other words unable to observe both risks and abilities.

Chetty and Saez contribution is mainly devoted to correct the standard optimal income tax formula with the presence of a private insurance. In this respect, their various tax formula extend the one provided by Petretto (1999, (21) and (22)), applying to many forms of social insurance, not only health insurance, and given the adverse selection in a continuum of individuals. However, just for giving a sketch, let us ignore the latter and denote with t_s the “tax rate” chosen by the government and with t_p the “tax rate” in the private insurance contract. The two rates give the extent respectively of social and private insurance. Let denote with z the earning of type- n individual and $Z = \int zf(n)dn$ the average value in the population. The individuals are risk-averse so would like to insure themselves against the risk of having low-income realizations (e.g. due to a treatment expenditure) and $w = (1 - t_p)z + t_p Z$ is the net-of-private insurance

income. Government taxation applies to the net incomes w^{17} , thus $c = (1-t_s)w + t_s W$, $W = \int wf(n)dn$, is the final, after the two insurances, disposable income. Let τ denote the total tax rate, defined as $(1-\tau) = (1-t_p)(1-t_s)$, and now $c = (1-\tau)z + \tau Z$. If the private insurer and the government cooperated to set τ , to maximise social welfare, the resulting contract would be identical to that described in the standard optimal taxation setting. However, as pointed out in Petretto (1999) and Boadway et al. (2006), private insurers take the government contract t_s as given when they chose t_p , and $t_p(t_s)$ is the corresponding reaction function, analogous to $k_i(\cdot)$ used in formula (15).

Chatty and Saez show that, taking the function $t_s \rightarrow t_p(t_s)$ as given, the optimal government tax formula is as follows (u' is marginal utility of income and U' is the average in the population):

$$\frac{t_s}{1-t_s} = -t_p + \frac{1-r}{\varepsilon_{W,1-t_s}} \frac{-Cov(w,u')}{WU'} \quad (17)$$

$r = -\frac{d \log(1-t_p)}{d \log(1-t_s)}$ denotes the empirically observed rate at which public insurance

crowds out private insurance. If $r=0$, there is not crowd-out. If $r=1$, there is perfect crowd. $\varepsilon_{W,1-t_s} = \frac{d \log W}{d \log(1-t_s)}$ denotes the elasticity of average, post-insurance, income w.r.t. the net-of-tax rate $(1-t_s)$, taking into account the endogenous response of private insurance t_p to a change in t_s .

According to (17), private insurance affects the formula for optimal tax rate in two ways. First, the term $-t_p$ on the r.h.s. reflects the reduction in the optimal level of government taxation given the presence of private insurance. Second, the standard inverse elasticity term $\frac{1}{\varepsilon_{W,1-t_s}} \frac{-Cov(w,u')}{WU'}$ is multiplied by $(1-r) < 1$, making the optimal government tax rate, and then social insurance, once more smaller. Such a integration designs a multi-pillar structure for many social protection sectors, and then also for health care.

5. Summarizing and concluding remarks

¹⁷Here we are presenting the case where private insurance is not optimally chosen. For the extension two a multi-stage game where also consumers optimizes the choice of insurance see Proposition 2 of Chatty and Saez paper.

In this work we have been surveying health care systems in order to underline the boundary between public and private institutional involvement in this area, although this apparent contrast is not actually meaningful for rightly enlightening the differences among various systems. Let us give some synthetic sketches of the arguments formerly carried on.

First of all, on examining the features of public intervention in health care, it is necessary to distinguish the motives for public provision from those for public production. The two notions do not coincide and the two forms of public intervention should not be examined jointly. Further, when public production is preferred, this can be integrated or separated from the purchasing of health services made by a public entity or an insurer, on the behalf of the citizens enrolled in the NHS. The choice of this configuration may be usefully analysed in terms of the I-O and property rights theory of cost-benefit of vertical integration of a firm. However, we do not achieve a theoretical conclusive answer to this important institutional question, that must be therefore verified according to the prevailing socio-economic context.

The health care organization systems are a lot, a sort of continuum, and, at the same time, they must not be identified with the as well several funding systems. For instance the NHS of UK, although fully public in funding, is a managed competition system with the separation of public Trust hospitals from the District health authorities and the freedom by patients, and general practitioners, in choosing the providers and the producers of services is allowed.

The health systems, where the private insurances strongly prevail, like in USA, are quite costly and do not guarantee an adequate coverage of sickness risks, so they are now everywhere integrated by social insurance, as the recent Obama's reform is proposing. However, also fully centralised command & control systems find it hard to reach the planned equity aims, given the lack of information by the planner and the conflicting individual incentives of the many involved agents. These systems have been as well generally dropped out by the reforms toward mixed systems carried on in most European countries in the last three decades. Among the mixed systems, the managed competition in health care, a regime widely applied in Europe, might reach appreciable results in terms of efficiency and equity. However, it needs a fairly territorial distribution of good-quality providers and it calls for complicated and costly mechanisms of contracts regulation and ex-ante and ex-post controls.

All the health care funding systems, the NHSs as well, tend to follow the logic of insuring individual risks, and fulfilling, at the same time, an aggregate financial equilibrium. In this respect, the theory shows that a mixed system with of a social insurance, for an essential package of services, and a supplementary and integrative private insurance might represent an efficient configuration.

In many European systems the second pillar in health care is financed by integrative insurance funds, even public ones. In some countries, like Italy, there are somewhat polar systems where the wideness of the first pillar, given the increasing comprehensiveness of the ELC packages, has limited the expansion of the second pillar, actually preventing the achievement of a meaningful role by integrative insurance funds. However, in these cases, the large extent of essential package in the first pillar has not limited the size of the third pillar which has been instead increasing in the time (OECD 2009).

A system with an increasing range of treatments and services included in the essential package and strictly funded with central government taxation, although justified by equity concerns, could become, in the long run, unsustainable for the financial equilibria and for the level of aggregate tax burden. In perspective, the sustainability problems could be limited by widening the second pillar, together with a system of co-payments, even income-related. Despite several institutional problems, and often large administrative and transaction costs (Geichert 2009), this mixed system could assure the feature of universality with a high degree of public provision of health care services.

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