Hospital care organisation in Italy: a theoretical assessment of the reform

Rosella Levaggi

Abstract.

In Italy, a substantial proportion of health care is financed by the public sector; our history of high deficit and debt means that the objective to rationalise and control expenditure has become a priority for any effective government policy. The health care system has been widely reformed and a separation between purchasing and delivering the service has been enforced to mimic the structure of a competitive market. The organisation of the reformed internal market can however vary among regions in Italy. The aim of this paper is to assess the relative merits of the different form of organisations for secondary care in the context of the Italian health system. We will start from a review of the reformed Italian system and model the internal market for secondary health care in a context where information is symmetric. In the second part of the paper we allow for asymmetry of information, i.e. we assume that the hospitals might observe characteristics of the patients before setting their effort.

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Introduction

In Italy, a substantial proportion of health care is financed by the public sector; our history of high deficit and debt means that the objective to rationalise and control expenditure has become a priority for any effective government policy.

The health care system has been widely reformed and a separation between purchasing and delivering the service has been enforced to mimic the structure of a competitive market.

The parallel process of devolution has also implied that health care has become a regional competence. In Italy this process has implied that each Region has been able to choose not only which services to provide, but also how to organize the provision of health care.

The contract that regulates the provision of hospital care can in fact vary according to the organisation of the market; its distinguishing features being the method chosen to finance the provision and the rules for competition. Financial aspects are defined by output-related payment schemes and soft budget constraints while the rules for competition are more complicated, especially when private hospitals enter in the picture.

Internal markets for health care have mixed performances as cost containment and health gains and it is difficult to assess their relative merits. Enthoven (2002) points out that competition in this market is not likely to work very well and that “not anything that sounds like “competition or markets or private sector will necessarily improve economic performance”.

The cost for health care is in fact determined by quality, by the ability of the patient to take advantage of health care and by the effort of the medical staff. The relationship between quality and health gains is unobservable and unverifiable since it depends on personal characteristics of the patients that are often unpredictable. This makes it very difficult to define the structure of the market for health care and its incentives.

The aim of this paper is to study contracts for secondary care in the context of the Italian health care system. We will start from a review of the reformed Italian system to focus on the crucial points of the reform. In particular, we will model the internal market for secondary health care in a context where information is symmetric. In the last part of the paper we allow for asymmetry of information, i.e. we will assume that the hospitals might observe characteristics of the patients that become private information to the provider.

The article will be organised as follows: in the following section we present the main aspect of the reform, in section three we present the model and the assessment of the market form when information is symmetric. In section four we relax the assumption of symmetric information and in section five we compare the different market structures. Finally, in section six we present the conclusions of our analysis.
2. The reform

The Italian health care system has been widely reformed since 1992. Several are the features that have shaped our health care system. They have affected the organisation, the method to finance health care, the allocation of resources among the different tiers. France (2001) explains in detail the evolution of the Italian health care system and in this article we concentrate on the aspects that we think are more important for the organisation of hospital care.

As concerns hospital care, two are the key elements: the separation of purchasing and providing functions and the regionalisation of health care expenditure.

The first aspect is shared with many other reformed system while the second one is peculiar of Italy. As concerns the creation of an internal market for health care, the former USLs which were responsible for providing any health care need to their reference population (prevention, primary and secondary care, education, etc.) have been divided into purchasing units (the ASLs) and several providers. As concerns hospital care, the providers in the public health care system range from hospitals that are directly controlled by the ASL (presidi ospedalieri), public hospitals formally independent from the purchasers (Aziende Ospedaliere) and private firms that can compete with the public one for supplying services (Privati Acrreditati)\(^1\).

The peculiar characteristic of the Italian reform is that both finance and organisation of the service have been decentralised. Since 1998, in fact, a new regional tax, IRAP, has been introduced as the main source of finance for health care. The Regions have to deliver a minimum number of services defined by Central Government (LEA), but they have full discretion in providing any service over this minimum, provided that they find their own resources to finance the services. Another important characteristic of the reform is that at least three different ways to organise the internal market for health care have been foreseen and several variants have been adopted. To start with, let us review the three main systems to organise health care that have been chosen by Italian regions. They can be labelled as follows: ASL programmer, ASL sponsor, ASL third payer given the different role played by the ASL (the purchaser) on the market.

The first type of organisation (ASL programmer) foresees only a limited scope for competition, both in the public and the private health care system.

As a rule, the services are provided by public hospitals that are usually directly managed by the

\(^{1}\) In actual fact, the reform has allowed a wide range of organisations to compete in the market for health care. We can in fact have public and private research hospitals, non profit hospitals, public and private teaching hospitals, ambulatory care facilities, foreign providers. For our analysis we have concentrated on the three organisation presented in the text
ASL or on which the purchaser has a big influence in the decision process. Only the demand that the public health care system cannot meet is matched by the private sector, usually through contracts that define the quantity of services to be provided. In this case, competition is reduced to the minimum. This system adopts central procedures for booking lab tests, ambulatory visits and hospital care in order to offer the best possible match between supply and demand.

The second type of organisation is defined ASL sponsor. In this case, the regulator decides which services can be provided by the private sector in competition with public providers. They are usually services for which the public sector is in short supply and that do not have significant economies of scale.

For all the other services, the patient can choose any hospital he likes provided it belongs to the public health care system. Most of the public hospitals have become Aziende Ospedaliere and the system tries to enhance competition within the public sector. For the services that are not protected, the rules of competition are the same as for the ASL third payer.

Finally, the ASL third payer model presents the maximum effort towards competition. In this market the patient can choose to receive care from the provider he likes; private structures compete with the public sector for any service. A minimum standard as concerns quality is secured through the accreditamento process. This is a sort of quality manual that defines what are the baseline characteristics of the provider of each service.\(^2\)

Most of the public hospitals have been transformed into separated entities (Aziende Ospedaliere) with their own management. They are non profit organisation, they cannot change the destination of use of the firm, their management should pursue at least cost minimisation, but can set their own objectives.

Each region in Italy has chosen its own organisation within this framework. Emilia Romagna has adopted the first model, Lombardy the latter. All the other regions have a mixed system within this range. Given the variety of forms in which the competition has been organised, it seems quite natural to ask whether some of this form are superior to others. In doing this analysis, there are several factors to be kept in mind: the separation of functions certainly enhances productivity incentives, but at the same time it increases asymmetry in two important directions: the objectives pursued by the actors in the game and the observation of important parameters related to the cost and the quality of the service.

The second important element of the reform is the choice of the payment system which is based on

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\(^2\) At first the accreditamento was necessary only for private firms, but in the recent past the same process is done also for public providers.
a prospective-output based payment system where the product is defined according to the DRG system. The most recent literature (Chalckley and Malcomson, 1998; Levaggi, 2004) show that this system might have important cost inflation properties since the risk sharing implied by the contract structure is not supported by the timing of information. A prospective payment system in fact implies that the risk in the variance of the cost of production has to be borne by the provider. However, this agent might be able to observe the severity of the patient before making his effort. In economic terms, this means that he does not bear any risk because his effort is stage contingent. In this environment the risk can only be virtually shifted from the purchaser to the provider and in actual fact the provider will either ask for a higher price (Levaggi, 2004) or it will use specific skimming procedures (Levaggi and Montefiori, 2005 a;b).

3. The internal market for hospital care

Any privatisation implies a process by which a productive unit becomes autonomous. Central Government loses its control over the firm as concerns the observation of costs of production and strategy setting, but the market is the new benchmark for the firm: if it becomes efficient, it will survive.

In the market for health care, the problem faced by the regulator is more complicated given that the product is not sold on a market. In general, in fact, the patient does not pay out of pocket for the care he receives so that the regulator has still to set the price to be reimbursed.

This is basically the reason why in health care several models have been developed for organising hospital care and why it is so difficult to assess whether some of these forms are superior to the others.

After the reform, hospitals in Italy have different degrees of independence from the public sector. The degree of autonomy of the hospital is an important element in determining its objectives, the incentives to cost minimisation and the quantity of information that can be extracted at no cost.

For the purpose of our analysis, we have grouped the institutional arrangements for hospitals in three different categories that are presented in table 1.

<table>
<thead>
<tr>
<th>Tab. 1: The taxonomy of hospitals competing on the market</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
</tr>
<tr>
<td>Private (PR)</td>
</tr>
<tr>
<td>Directly controlled (AO)</td>
</tr>
<tr>
<td>Directly managed (PO)</td>
</tr>
</tbody>
</table>
Private hospitals (PR) are separated entities from the purchasers, they have the right to withhold information from the purchaser as concerns their running costs and usually pursue the objective to maximise their surplus. A contract has to be made to get their services and they can refuse any clause that limits their independence. The incentive to cost minimisation are maximum since these hospitals are run as a private firm.

Hospitals that are directly controlled (AO) are public firms with a high degree of independence as far as their organisation is concerned. ASL can force them to reach some common objectives, but they are not constrained to reveal any private information on their running costs. They are assumed to maximise their reputation. Within the system some hospitals might have lesser degree of independence; in particular some of them might not have the right to refer patients to other hospitals. These restrictions create slacks in the productive process and inflate their cost by an x-inefficiency parameter $x_{AO}$.

Finally, the hospitals that are directly managed have a limited degree of autonomy; they do not have the ability to withhold information from ASL that can make them to pursue its own objectives. These constraints means more slacks in the productive process an cost inflation by an x-inefficiency parameter $x_{PO} > x_{AO}$.

The model will study the interactions between these hospitals using the theoretical framework developed in Levaggi (2004a,b) and Levaggi and Montefiori (2005a,b). for comparing the performances of the different systems that italian regions have chosen to organise health care.

4. The model

The model presented here develops a three-stage game from the standpoint of a collective purchaser (ASL) that buys health care from two providers located at the extremes of a line whose distance has been normalised to one. There are three different types of ASL: a third payer that employs a private and a public hospital, a sponsor that employs two public hospitals and a programmer that instead directly manages the two hospitals.

We have chosen these three forms to characterise each type of organisation since they represent the predominant form. The community is made up of N patients, uniformly distributed on a line of length one. In the first stage of the game, the effort of the management is defined through cost minimisation and the payment is defined for a set quality level; in the second stage, the two hospitals compete for patients through quality using the rules of the spatial competition à la Hotelling. The results of the second stage allows ASL to define a relationship between reimbursed

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3 in some cases the market uses a combination of the three models described here and the assessment has to be done for each service separately
and delivered quality which will be used in the third stage to define the payment scheme that allows to provide health care to all the patients on the line.

4.1 Stage one: the payment scheme

The environment is characterised by asymmetry of information on cost observation, but in this first stage it will be assumed that patients’ characteristics are observed by the hospital only after making his effort as shown in figure one:

**Fig.1: The timing of information**

<table>
<thead>
<tr>
<th>ASL sets contract</th>
<th>realisation of $\beta$</th>
<th>outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>effort by hospital</td>
<td>hospital observes $\beta$</td>
<td></td>
</tr>
</tbody>
</table>

When the contract is stipulated both parties have the same information on $\beta$, the hospital can observe it before the end of the contract, but only after setting its effort and can hide this information from the purchaser. If the hospital is under direct management both agents can observe $\beta$ and the game becomes of symmetric information.

The cost incurred by the hospital to produce health care is assumed to be a linear function of quality, patients’ characteristics and the effort of the medical staff.

The model presents three types of asymmetry of information on costs: the first derives from uncertainty about the patient type while the other two depends on the separation between purchasing and providing functions. The first error, $\varepsilon$, is a measurement term that depends on the imperfect observation of the actual cost by the purchaser, the second one $x$ derives from the inability to evaluate the minimum cost to produce that specific service, i.e. to estimate the x inefficiency parameter of the provider:

$$ C_q = c_i + \beta_i + q + x_j - e_i \quad i = l, h \quad j = PR, AO, PO \quad (1) $$

where $\beta_i$ is a patient-related cost, $q^*$ is the quality level, $e_i$ is the effort of the medical staff and $x_j$ is an x-inefficiency parameter related to the organisation of the hospital with $x_{PR}=0$ and $x_{AO}<x_{PO}$. $\beta_i$ is a random variable that assumes two values, $\beta_l$ for patients with low severity and $\beta_h$ for patients

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$q^*$ is not the actual quality offered by the hospital, but there is a strict and observable relationship between the quality reimbursed and the one that is actually delivered which derives from the second stage of the game. For the cost minimising stage this problem in not important since it does not alter the results of the analysis.
with high severity\(^5\). Both events have a known probability equal to \(p\) and \((1-p)\) respectively.

\(c_j\), the production cost is observed by the hospital has to be estimated by the purchaser. \((c^R_j = c_j + m_j)\). \(m\) is a measurement error from the minimum cost which depends on the degree of autonomy of the provider and has two components: the first is \(x_j\), the inefficiency level of production and the second one which is a true measurement error that depends on the degree of independence of the hospital. In particular it will be assumed that it is equal to zero for hospitals that are directly managed and increases with the degree of independence of the hospital, i.e. \(\varepsilon_{po} = 0 < \varepsilon_{jo} < \varepsilon_{pr}\). We keep the two errors separated since they have different effects on the reaction function to quality setting.

Quality is a multidimensional vector that includes medical and non-medical variables that affect the outcome of health care, i.e. prevention, treatment and aftercare\(^6\). Both medical and non-medical quality are extremely relevant to determine patient utility. At this stage we assume quality to be a scalar including all the relevant aspects of interest; when asymmetry of information is introduced we will explicitly model the characteristics of quality. The effort produces a disutility that is linear in the number of patients, but increasing in the effort, i.e. \(f(e, n) > 0; f'_e(e, n) > 0; f'_e(e, n) > 0; f'_n(e, n) > 0; f''(e, n) = 0\)

The hospital management participates to the production process only if the reward received, net of the cost of production, produces a positive expected utility:

\[
E[\tau - C - f(e)] \geq 0
\]  

The choice of the reimbursement scheme depends on the institutional setting; in Italy, a prospective payment system based on DRG definition of the output has been envisaged for hospital care. It consists of an output-related scheme that foresees a fixed payment for each service produced. In a context where the costs of hospitals can be observed with a different degree of precision, output-related schemes are less flexible than cost reimbursement because they do not allow any form of price discrimination and rents deriving from asymmetry of information and \(x\) inefficiencies have to be paid to both competitors\(^7\). However, given that this is the system of reimbursement chosen, we will compare the three different market structures using a prospective payments scheme.

### 4.1.1 The reimbursement scheme

For a given quality level, the ASL has to find the payment that minimises the cost; the problem can be written as\(^8\):

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\(^5\) It is assumed that morbidity is correlated with the recovery speed of the patient and hence with cost. If severity is low, the recovery rate is high and hence cost is low.

\(^6\) The same approach is used by Chalkley and Malcomson (1998).

\(^7\) for discussion of its merits and shortcomings see Ellis and McGuire (19869, Ma (1994), Malcomson and Chalckley (2002), Levaggi (2004b)

\(^8\) See Levaggi (2004a) for a formal proof.
\[ \begin{align*}
\text{Min } & \quad t \\
\text{s.t.} & \quad C_i = c_i^R + q_i + \beta_i + x_j - e_i, \quad i = l, h \\
& \quad t - E(C_i - f(e_i)) \geq 0
\end{align*} \]

and the optimal solution can be written as:

\[ f^*(e_i) = 1 \]
\[ t^* = E(C_i^*) + f(e^*) = q^R + E(\beta_i) + x_j + c + e_j - e^* + f(e^*) = q^R + C_i^{\min} + x_j + e_j \]

where \( C_i^{\min} \) is the minimum cost to offer a service with quality equal to zero.

For our three market structures, the reimbursement \( t \) can be written as:

<table>
<thead>
<tr>
<th>Market structure</th>
<th>Reimbursement scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASL programmer</td>
<td>( q^R + C_i^{\min} + x_{PO} )</td>
</tr>
<tr>
<td>ASL sponsor</td>
<td>( q^R + C_i^{\min} + x_{AO} + e_{AO} )</td>
</tr>
<tr>
<td>ASL third payer</td>
<td>( q^R + C_i^{\min} + x_{AO} + e_{AO} )</td>
</tr>
</tbody>
</table>

In the first case, the ASL pays the highest cost inflation deriving from \( x \) inefficiency, but it can observe costs; for the other two markets, there is a reduction in the slack of production, but there is a higher cost deriving from the possible mistakes in calculating the expected cost. The two latter markets have the same reimbursement scheme because, given the uniform pricing rule and the asymmetry on cost, the private hospital has to be paid the inefficiency cost of the public one. The second alternative open to the purchaser in the latter case would be to estimate the cost of the private hospital which however has not any interest in disclosing this information and it would never declare a cost lower than \( q^R + C_i^{\min} + x_{AO} + e_{AO} \).

### 4.1.2 Second stage: quality determination

In the second stage of the game, given the reimbursement scheme, the two hospitals compete for patients using the rules of spatial competition.

The population needing health care consists of \( N \) patients, uniformly distributed on a unit line while the two hospitals are located at the extremes (0 and 1). The hospitals have the same size and technology, but they might differ in their degree of independence from ASL.

The service is free at the point of use while travelling costs have to be borne by the patient. Each patient is indexed by \( d \in [0,1] \), so that \( d \) represents the patient located at point \( d \) from the origin.
Patients observe quality and incur the same marginal distance cost $s$; they choose to go to the hospital that maximises the difference between quality and travelling cost. The utility function of a patient located at point $d$ depends on the hospital he gets admitted to and it can be written as:

$$V_d = \begin{cases} \varphi q_0 - sd \\ \varphi q_1 - s(1-d) \end{cases}$$

(5)

where $\varphi_q$ is the monetary evaluation of hospital services of quality $q$ from the hospital located at $i$ (0 or 1 in this model); $sd$ and $s(1-d)$ are travel costs. Patients have the same valuation of quality characteristics and incur the same marginal distance cost $d$; they are indifferent between the two hospitals when $\varphi q_0 - sd = \varphi q_1 - s(1-d)$. This expression can be solved for the location of the marginal consumer:

$$d = \frac{\varphi (q_0 - q_1)}{2s} + \frac{1}{2}$$

(6)

The demand for hospital $i$ is obtained multiplying the distance by the density which, given the unit length of the line, is equal to $N$. The demand for each hospital can then be written as:

$$D_i = \left[ \frac{\varphi (q_i - q_j)}{2s} + \frac{1}{2} \right] N$$

(7)

The hospitals that are directly managed will choose $q^{PO}=q^R$; public hospitals maximise the number of patients and private hospitals instead choose the level of $q$ that maximises their total surplus:

$$Max \quad S^{tot} = \left[ T - E(C^*) - f(e^*) \right] D_i$$

(8)

Given that the price rules have already been defined, we can write the unit surplus as:

$$q^R + (x^R - x_j) + e_i - q_j$$

(9)

Public hospitals want to maximise $D$, but they have to be budget balance. This means that the quality level that they choose will be equal to $q^{AO} = q^R + e_{AO}$.

For private hospital, the F.O.C. can be written as:

$$-D_i + (q^R + (x^R - x_j) + e - q_j) * \frac{\varphi N}{2s}$$

(10)

Substituting for $D_i$ and solving for $q$ we obtain:

$$q^{PR} = \frac{1}{2} (q^R + q_i + e + (x^R - x_j) - \frac{s}{\varphi})$$

(11)

This expression shows that there is a trade off between the payment made in excess of cost, the quality offered by the hospital and the position rent. This becomes quite important in the evaluation
of the minimum cost to deliver health care; the type of competition developed might allow ASL to get back in the form of better quality some of rent it has to pay for asymmetry of information and spatial monopoly.

However, given that costs cannot be observed, there is a difference between the quality that ASL expects the hospital to deliver and the true one. As a consequence, the cost of provision is usually higher than the minimum cost, but the net utility the patients enjoy from health services is positive. The choice of quality by hospitals in the three structures are presented in table two.

Tab 2: The choice of the quality level

<table>
<thead>
<tr>
<th>Market structure</th>
<th>Quality as expected by ASL</th>
<th>True quality delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASL programmer</td>
<td>( q_{PO} = q^R )</td>
<td>( q_{PO} = q^R )</td>
</tr>
<tr>
<td>ASL sponsor</td>
<td>( q_{AO} = q^R )</td>
<td>( q_{AO} = q^R + \varepsilon_{AO} )</td>
</tr>
<tr>
<td>ASL third payer</td>
<td>( q_{AO} = q^R )</td>
<td>( q_{AO} = q^R + \varepsilon_{AO} )</td>
</tr>
<tr>
<td></td>
<td>( q_{PR} = q^R - \frac{1}{2} \frac{s}{\varphi} )</td>
<td>( q_{PR} = q^R + \varepsilon_{AO} + \frac{1}{2} \left( \frac{x_{AO} - s}{\varphi} \right) )</td>
</tr>
</tbody>
</table>

For the first two types of market, hospitals are symmetric and have a shared objective. Given that AO wants to maximise the number of patients treated, they will increase by \( \varepsilon \) the quality reimbursed \( q^R \). For an ASL third payer objectives of the two hospitals are not symmetric. While the public firm passes onto the patient any reimbursement received in terms of quality, the private hospitals uses part of the money to increase its profit.

4.1.3 Stage three: the choice of the optimal quality level

In the third stage, ASL sets \( q^R \). There are several ways in which this can be done. We might alternatively think that the purchaser wants to maximise the welfare of its community, that it wants to minimise the cost of provision or that it wants to find a trade off between quality and cost. Any of this objectives can be sustained or criticised. For our analysis, given that the aim is to compare different market structures, it is important to give a common objective that is going to have enough flexibility to allow for cost and welfare consideration. Given that the ASL derives his finance from a fixed budget constraint, we have preferred to choose a sort of equity approach: the ASL wants his patients receive a non negative utility from health care; this means that the marginal patient should get his reservation utility when admitted.

However, given the asymmetry on cost observation, this objective might not in practice be attained. The ASL in fact sets \( q^R \) according to the quality the hospital is expected to deliver while in fact the
quality delivered might be different as shown in table two. For this reason, a comparison of the markets has to be done on cost and utility of the patients.

In this section we define quality setting by the ASL and we use expected quality measures. When both hospitals share the same objectives, they share the market equally and the marginal patient is located at $d=1/2$. For two directly managed hospitals, this means that:

$$\varphi q_{PO}^R - \frac{s}{2} = 0 \quad \text{with} \quad q_{PO}^R = \frac{s}{2\varphi} \quad (12a)$$

When two AO compete in the same market they want to maximise their market share and since they have the same objectives, they will share the market equally as in the previous case and the ASL sets the quality to the same level:

$$\varphi q_{AO}^R - \frac{s}{2} = 0 \quad \text{with} \quad q_{AO}^R = \frac{s}{2\varphi} \quad (12b)$$

Finally when a public hospital and a private one compete, they do not supply the same quality level hence they will not share the market equally because the marginal patient is not located at $1/2$. ASL finds the quality level that clears the market and the market shares of the two hospitals solving the following system:

$$q_{mix}^R = \frac{s}{\varphi} d_1 \quad (I)$$

$$q_{mix}^R - \frac{1}{2} \frac{s}{\varphi} d_2 = \frac{s}{2\varphi} \quad (II)$$

$$d_1 + d_2 = 1 \quad (III)$$

hence $$q_{mix}^R = \frac{3s}{4\varphi}$$

The ASL expects the market to be served for $3/4$ by the public hospital and for $1/4$ by the private one.

4.2. Comparing the different markets

In this section we compare the different market settings using a welfare maximisation approach. To do so, we evaluate the ex post welfare of each institutional arrangements taking account that the true reaction function of the hospitals might be different from what the ASL was expecting given that the cost cannot be perfectly observed.

Only in the case of an ASL programmer in fact the ex post quality level set by both hospitals will be equal to the expected level $q^R$. 

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For the first two market structures, the behaviour of the two hospitals is symmetric so that they
divide the market equally. The quality offered will however be equal to \( q^R + \varepsilon_{AO} \)

In a mixed market (ASL third payer), the quality served by the two hospitals and their market share
will be different from the expected one, given the asymmetry of information on cost. In this case in
fact the quality level will be equal to:

\[
q^{AO} = \frac{3s}{4\phi} + \varepsilon_{AO} \\
q^{PR} = \frac{3s}{4\phi} + \varepsilon_{AO} + \frac{1}{2}(\chi_{AO} - \frac{s}{\phi})
\]

and the market will be shared as follows:

\[
\frac{3}{4} - \frac{q^{AO}}{4s} \quad \text{public hospital} \\
\frac{3}{4} + \frac{q^{AO}}{4s} \quad \text{private hospital}
\]

(14) (15)
Tab. 3: Cost and utility from the different settings

<table>
<thead>
<tr>
<th></th>
<th>Cost for health care</th>
<th>Utility from health care</th>
<th>(surplus of private hospital)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optimal solution</strong></td>
<td>$N \left( \frac{s}{2\phi} + E^{min} + f(e) \right)$</td>
<td>$\frac{s}{4} N$</td>
<td></td>
</tr>
<tr>
<td><strong>ASL programmer</strong></td>
<td>$N \left( \frac{s}{2\phi} + E^{min} + f(e) + x_{PO} \right)$</td>
<td>$\frac{s}{4} N$</td>
<td></td>
</tr>
<tr>
<td><strong>ASL sponsor</strong></td>
<td>$N \left( \frac{s}{2\phi} + E^{min} + f(e) + x_{AO} + \epsilon \right)$</td>
<td>$\left( \frac{s}{4} + \phi \epsilon \right) N$</td>
<td></td>
</tr>
<tr>
<td><strong>ASL third payer</strong></td>
<td>$N \left[ \frac{3s}{4\phi} + E^{min} + f(e) + x_{AO} + \epsilon \right]$</td>
<td>$\frac{s}{4} + \phi \epsilon + \frac{x_{AO}}{16} (x_{AO} + 3 - \phi ) N$</td>
<td>$N \left( \frac{s}{4} + \frac{x_{AO}}{4s} \right) \left( \frac{3}{4} - \frac{\phi x_{AO}}{4s} \right)$</td>
</tr>
</tbody>
</table>
Table three shows that the comparison of the two market structures cannot be done on cost alone. The asymmetry of information on cost observation means that the ex post equilibrium is different from the one foreseen by the health authority where the chosen quality level would imply a zero surplus for the marginal consumer.

In the first line, a benchmark solution where ASL knows all the costs and can implement the minimum cost solution is presented. The ASL programmer has a higher cost due to the lack of incentives to cost reduction, but the total consumer surplus is the same. For the ASL sponsor, the difference in cost depends on $\varepsilon$. If $\varepsilon < x_{PO} - x_{AO}$, this market structure should be preferred to the previous one. The measurement error $\varepsilon$ paid to the hospitals increases consumer welfare by $\varphi \varepsilon N$, i.e. the entire extra payment is transformed into extra utility for the patients.

As concern the third market, we observe that the cost is definitely higher than for an ASL sponsor since in this case the quality to pay is higher. The extra payment is transformed in part in an higher utility for the patients and in surplus for the hospital.

In a static framework, it might then seem that competition in the market for health care does not produce significant effects on the cost reduction side. The use of this market might then be justified only if one can think that the public hospital, in an attempt to increase its market share, will reduce its inefficiency level $x_{AO}$ which in turn might determine a reduction in the reimbursement cost in the long run. It is interesting to note that the private hospital has not instead almost any incentive to pass onto the consumer more reimbursement in terms of quality in order to increase its market share. The policy described so far allows the private hospital to maximise its quality and starting a war with the public hospital would not produce any benefit.

5. Asymmetry of information on patient type

The conclusions just presented do not however take account of another quite important element, i.e. the fact that the hospital can observe patient’s type before making its effort. In this case, it might be possible that some hospitals more than others choose the patients to be admitted. This behaviour, that the literature has defined as cream skimming, dumping and skimping (Ellis, 1997; Lewis and Sappington, 1999) is illegal and the hospital that is found to engage in it might be severely punished, but it is in fact quite used in the market. The timing of information in the contract can be summarised as follows:

*Fig.2 The timing of information when information is asymmetric*
When the contract is stipulated, both parties have the same information on \( \beta \), but the hospital can observe it before setting his effort and can hide it from the purchaser. This has important consequences on the total cost to provide health care and on the welfare of the community.

Choosing patients is an illegal behaviour and the hospital that wants to pursue this strategy has to be very careful in the way it undertakes it. To introduce this aspect in our model, we explicitly model the multidimensional aspect of quality that was pointed out in the previous paragraph. The medical quality typically includes aspects like appropriateness, health, nursing, aftercare, etc., while the non-medical quality includes comfort, information, kindness, catering service and so on. In particular we assume that the quality delivered by the hospital is made up by three elements:

- a minimum quality level that is implicit in the definition of \( \beta \) and that determines the minimum level of medical resources that are necessary to make the treatment effective;
- hotel services \( (q^H) \) which comprises all those services that are not strictly medical, but that can improve patient’s stay in hospital. They are services such as the number of beds per room, hours of visits, private telephones, nurses per ward, etc.
- health related services \( (q^M) \) that might improve the quality of the care delivered.

\( q \) is then the sum of the two last components:

\[
q = q_i^H + q_i^M
\]  

They are assumed to be perfect substitutes and their cost of provision is constant and equal to one to simplify the exposition. With this new hypothesis the cost for hospital services can be written as:

\[
C_i = c_i + \beta_i + \hat{q}_i + \hat{q} + x_j - e_i \quad i = L, H \quad j = PO, AO, PR
\]  

For this part of the analysis, given that the results of the two models are not comparable, we have assumed that there is no measurement error, i.e. \( \varepsilon = 0 \). This allows to simplify the algebra without loss of generality.

We assume that the patients have not uniform preferences for quality. In particular, we assume that those with a higher degree of severity (hence of costs) are more interested in health related quality. The perceived level of quality for the two groups can be written as:

\[
q_L = wq^H + (1-w)q^M
\]

\[
q_H = (1-w)q^H + wq^M
\]  

To simplify the algebra and the exposition we assume that low severity patients care only for hotel quality while high severity are interested only in medical quality. This assumption can be justified.
on the ground that \( q \) represent the extra quality beyond the minimum level (set to zero in our model) that defines the treatment as appropriate and effective\(^9\).

These preferences cannot be observed by the purchaser that can only observe the average preference, i.e:

\[
q = pq_L + (1 - p)q_H = pq^M + (1 - p)q^M
\]

(19)

Public managed hospitals are assumed to be unable to discriminate among patients and are asked by ASL to set the quality level that is preferred by the average patient.

Given that the quality level cannot be observed or verified, AO and PR can strategically choose a quality mix that allows to pursue their goals.

Private hospitals still pursue surplus maximisation. For AO, their strategy setting is more complicated. The objective of maximising their reputation can in fact be pursued in several ways: they might want to maximise the number of patients they treat or follow the strategy of treating severe cases in order to gain reputation in the medical profession. In the first case, they will try to attract low cost patients while in the second case they will set medical quality very high in order to attract patient with a severe condition.

It is important to note that cream skimming is only possible in a market where the two hospitals have asymmetric behaviours; if in fact both structures fix their quality to the same level, they will end up dividing the market equally independently of the quality they offer.

The number of possible cases to examine in this context becomes rather high; in what follows we assume the following strategies for hospitals competing in the market that correspond to the more likely behaviour of the competitors in the market.

<table>
<thead>
<tr>
<th>Market structure</th>
<th>Quality setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASL programmer</td>
<td>( q^{po} = pq^M + (1 - p)q^M )</td>
</tr>
<tr>
<td>ASL sponsor (1)</td>
<td>Both hospitals compete on medical reputation (high cos patients)</td>
</tr>
<tr>
<td>ASL sponsor (2)</td>
<td>One hospital maximises market share; the other medical reputation</td>
</tr>
<tr>
<td>ASL third payer</td>
<td>AO maximises its medical reputation and PR maximises surplus</td>
</tr>
</tbody>
</table>

For an ASL third payer we need to find the level of quality that maximise the surplus of the private hospital, given that the strategy of AO is to maximise his medical reputation. Given that cream skimming is an illegal behaviour, AO sets his quality to \((0, \frac{3s}{4\varphi})\) without taking account that this

\(^{9}\) The more general case is presented in Levaggi and Montefiori (2004).
strategy might not allow to be budget balanced. The problem for the private hospital can be written as:

\[
\begin{align*}
Max & \quad \Pi = \left[q^H - q_{PR}^H - q_{PR}^M + E(\beta) - \beta_L \right]p \left[\frac{\phi}{2s} (q_{PR}^H - 0) + \frac{1}{2}\right] + \\
& \left[q^R - q_{PR}^H - q_{PR}^M + E(\beta) - \beta_H \right](1 - p) \left[\frac{\phi}{2s} (q_{PR}^M - 3s) + \frac{1}{2}\right]
\end{align*}
\]

s.t
\[q_i^H \geq 0\]
\[q_i^M \geq 0\]

The problem can be solved using Kuhn Tucker conditions. The results can be summarised as follows:

\[
\begin{align*}
q_{PR}^H &= \frac{1}{2} \left[ \frac{3s}{4p\phi} + (1 - p)(\beta^H - \beta^L) + x_{AO} - \frac{s}{p\phi} \right]; q_{PR}^M = 0; p > \frac{1}{2} \\
q_{PR}^M &= \frac{3s}{4\phi} + \frac{1}{2} \left[ x_{AO} - (1 - p)(\beta^H - \beta^L) - \frac{s}{(1 - p)\phi} \right]; q_{PR}^H = 0; p < \frac{1}{2}
\end{align*}
\]

The proof of this result is presented in appendix two. The intuition behind it can be explained as follows: given that the two sets of patients have polar preferences as concerns the two quality types, the hospital maximises its surplus by specialising in one of the two qualities. Given that the marginal cost and benefit of treating both set of patients is the same, the profit is maximises for the quality that has the maximum revenue in terms of patients. In our model this element is represented by \( p \), the probability of being ill.

Cream skimming can also be used by public hospitals for maximising their goals. For the ASL sponsor market we will consider two cases: one in which both hospitals wants to maximise their medical reputation and set \(( q^M = q^H )\) and a second one where one wants to maximise the number of patients treated and the other one medical quality. As for the previous market, cream skimming is successful only if the behaviour of the two hospitals is not symmetric. In the first case, in fact the hospitals share the market equally.

When behaviour is not symmetric, the problem for the hospital that wants to maximise the number of patients treated while being budget balanced can be written as:
Max $\frac{1}{2} + p \frac{\varphi}{2s} (q_i^H - 0) + (1-p) \frac{\varphi}{2s} \left( q_i^M - \frac{2s}{\varphi} \right)$

s.t.

\[
\begin{align*}
q_i^R - q_i^H - q_i^M + E(\beta) - \beta_i & \left[ p \left( \frac{\varphi}{2s} (q_i^H - 0) + \frac{1}{2} \right) + ight] + \\
q_i^R - q_i^H - q_i^M + E(\beta) - \beta_i & \left[ 1 - p \right] \left( \frac{\varphi}{2s} \left( q_i^M - \frac{2s}{\varphi} \right) + \frac{1}{2} \right) \geq 0
\end{align*}
\]

(22)

\[
q_i^H \geq 0 \\
q_i^M \geq 0
\]

In this case, the solution can be written as $(q_i^{HO}) = \frac{s}{2\varphi} + \frac{p(1-p)(\beta^H - \beta^L)s}{2p\varphi(1-p)(\beta^H - \beta^L) + (5-p)s}; q_i^{MO} = 0)_{10}$

The solution is, as in the previous case, quite intuitive. The hospital receives a reimbursement equal to $s/2\varphi$ and gets an extra surplus equal to $(1-p)(\beta^H - \beta^L)$ for each low cost patient it treats, a surplus which can be used to increase quality. However the hospital has to take account that setting $q_i^M=0$ does not guarantee that any low cost patient comes to the hospital. In actual fact, $\frac{1}{4}$ of them gets to this hospital producing a deficit equal to.. For balancing the accounts, the hospital has then to use some of the surplus deriving from low cost patient to cover this loss.

**5.1 Comparing the different solutions**

In this part we will compare the solutions deriving from this analysis with information asymmetry. The task is rather complicated since the different market forms involves difference in cost and differences in consumer surplus, both as concerns its total amount and its distribution among low and high cost patients.

The first important thing to note is that since both groups of patients prefer a different type of quality, the optimal solution would be to give a personalised treatment to each of them according to their preferences. Since this policy cannot be implemented for several reasons, a pooling equilibrium has to be defined where the quality mix depends on the average preference of the two groups. For this reason, the results presented in table four and table five are not directly comparable; what it is possible to compare are the differences within the table. The ex ante cost to provide health care are the same as in a context of symmetric information, but ex post cost can be different when one of the two hospitals has a deficit. For the three market forms, what changes is the allocation of benefits among the two groups of patients. For a market organised according to the rules of an ASL

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\[10\] The proof is presented in appendix…
programmer, both groups enjoy the same level of surplus, which is half the optimal one given the pooling of quality. An ASL sponsor organisation where both hospitals supply medical quality has a lower total surplus, but there is also a distribution of net benefits towards the high cost one which enjoy the same utility as in an optimal market.

For the two latter form of market, the ex ante cost is the same as in the symmetric case, but ex post cost are different since one of the hospital might run into a deficit because of the policy adopted by their competitor.

For the ASL sponsor case, there is a redistribution of benefit among the two groups of patients as shown in table five. For the ASL third payer, both groups suffer a loss of benefit while the private hospital experience a substantial increase in its profit. It is interesting to note that the surplus of the private hospital much depends on the reaction function of the public hospital. If AO adopts other strategies in setting its quality, in fact, the scope for cream skimming is very much reduced.

In some respects, this result shows that the opportunistic behaviour of both hospitals is responsible in determining the negative effects of cream skimming.

This means that also the regulator has its own responsibilities as concerns cream skimming; the soft budget constraint that some regional systems implicitly allows to the public hospitals does not improve the welfare of the market; the only effect is to increase the profit of the private hospital.

6. Conclusions

The internal market for health care that several reforms in western countries have introduced have mixed performances as cost containment and health gains and it is difficult to define an institutional arrangement that allows to keep a good balance between cost minimisation and health outcomes.

In this article the cost and welfare implications of the most common market form used in Italy to organise hospital care have been compared using a simple model where a purchaser (ASL) buys hospital care from two providers with fix location. The different institutional setting present a trade off between common goals and incentive to minimise cost: the more the control is stringent, the less incentive to an efficient use of the resources. The model also shows that in the presence of local monopoly and information asymmetry, competition hardly reduces costs. The model shows that the benefits from competition might be obtained in the long run, in particular in a structure where the private and the public compete.

The paper shows that the choice of the organisation and financial setting depends on the relative importance of three main elements: the extra cost caused by lack of incentives to efficiency, the information rent deriving from the separation of purchasing and providing functions and finally a
position rent each hospital enjoys and that can be extracted only in some cases.

In the second part of the paper we focus on a different problem deriving from information asymmetry, i.e. the possibility for the provider to attract patients with specific characteristics through a strategic quality setting.

In this case, the analysis becomes more complicated; we show that both public and private hospitals might have a scope for cream skimming procedures which affects the cost for health care and consumer surplus. In this second part the analysis is complicated by the range of assumptions that can be made about hospitals’ behaviour. This system has perverse incentive effects because both private and public hospitals might have an interest in the existence of vertical cream skimming: the private one since are allowed a surplus on top of the normal remuneration for their own effort and the public one because they might claim that cream skimming is the cause of their apparent inefficiency, even when it depends on slacks in the production process.

In general, we can conclude that also in this case, competition does not seem to bring substantial welfare improvements, at least in the short run.

Levaggi (2004) shows that the form of payment (the choice of an incentive compatible scheme) instead of a prospective payment system and the use of price discrimination might improve the performances of the internal market.

The paper presented here represents just a first step in the analysis of health care market; its structure is very simple and could be enriched by taking account of more complicated functional form for hospital costs and more diverging objectives for hospitals.
<table>
<thead>
<tr>
<th>Market structure</th>
<th>Quality</th>
<th>Market share</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASL programmer</td>
<td>( q_{PO}^H = p \frac{s}{2\varphi}; q_{PO}^M = (1 - p) \frac{s}{2\varphi} )</td>
<td>( L = H = \frac{1}{2}; \frac{1}{2} )</td>
</tr>
<tr>
<td>ASL sponsor (1)</td>
<td>( q_{AO}^H = 0; \ q_{AO}^M = \frac{s}{2\varphi} )</td>
<td>( L = H = \frac{1}{2}; \frac{1}{2} )</td>
</tr>
<tr>
<td></td>
<td>( q_{AO}^M = \frac{s}{2\varphi}; q_{AO}^M = 0 )</td>
<td></td>
</tr>
<tr>
<td>ASL sponsor (2)</td>
<td>( q_{AO}^H = 0; \ q_{AO}^M = \frac{s}{2\varphi} )</td>
<td>( L = \frac{3}{4} + \frac{p(1 - p)(\beta^H - \beta^L)}{4p(p - 1)(\beta^H - \beta^L)}; \frac{1}{4} )</td>
</tr>
<tr>
<td></td>
<td>( q_{AO}^H = \frac{s}{2\varphi} + \frac{p(1 - p)(\beta^H - \beta^L)}{2p(p - 1)(\beta^H - \beta^L)}; q_{AO}^M = 0 )</td>
<td>( H = \frac{1}{4}; \frac{3}{4} )</td>
</tr>
<tr>
<td>ASL third payer</td>
<td>( q_{AO}^H = 0; q_{AO}^M = \frac{3s}{4\varphi} )</td>
<td>( L = \frac{1}{2} + \frac{\varphi}{4} \frac{(\beta^H - \beta^L)(1 - p)}{4s} + \frac{x_{AO}}{16p} )</td>
</tr>
<tr>
<td></td>
<td>( q_{PH} = \frac{1}{2} \left[ \frac{3s}{4p\varphi} + (1 - p)(\beta^H - \beta^L) + \frac{x_{AO}}{p\varphi} \right] ); ( q_{PH} = 0 )</td>
<td>( H = \frac{7}{8}; \frac{1}{8} )</td>
</tr>
</tbody>
</table>
### Tab. 5: Cost and surplus comparison

<table>
<thead>
<tr>
<th></th>
<th>Cost to provide health care</th>
<th>Consumer’s surplus</th>
<th>Surplus or deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optimal solution</strong></td>
<td>( N \left[ \frac{S}{2\varphi} + E C_{\text{min}} + f(e) \right] )</td>
<td>( \left( \frac{S}{4} p + \frac{S}{4} (1 - p) \right) N )</td>
<td></td>
</tr>
<tr>
<td><strong>ASL programmer</strong></td>
<td>( N \left[ \frac{S}{2\varphi} + E C_{\text{min}} + f(e) + x_{p} \right] )</td>
<td>( \left( \frac{S}{8} p + \frac{S}{8} (1 - p) \right) N )</td>
<td></td>
</tr>
<tr>
<td><strong>ASL sponsor (I)</strong></td>
<td>( N \left[ \frac{S}{2\varphi} + E C_{\text{min}} + f(e) + x_{s} \right] )</td>
<td>( \left( -\frac{S}{4} p + \frac{S}{4} (1 - p) \right) N )</td>
<td></td>
</tr>
<tr>
<td><strong>ASL sponsor (II)</strong></td>
<td>( N \left[ \frac{S}{2\varphi} + E C_{\text{min}} + f(e) + x_{s_{II}} \right] )</td>
<td>( \left( \frac{S}{2} \left( 2p(p-1)(\beta^s - \beta^t) + (5-p)s \right) + \frac{S}{16} (1-p) \right) N )</td>
<td>( \begin{align*} A G_{I} &amp;= 0 \ A G_{II} &amp;= N(\beta^u - \beta^t) \left( \frac{1}{4} - p - \frac{p(1-p)(\beta^u - \beta^t)s}{2p(p-1)(\beta^u - \beta^t)s} \right) \end{align*} )</td>
</tr>
<tr>
<td><strong>ASL third payer</strong></td>
<td>( N \left[ \frac{3s}{4\varphi} + E C_{\text{min}} + f(e) + x_{s_{III}} \right] )</td>
<td>( \left[ \frac{1}{8} \left( \frac{p-e}{s} - \frac{1}{8p} \right)^2 - \frac{1}{4} \left( \frac{p-e}{s} - \frac{1}{8p} \right)^2 \right] p + \frac{17}{64} (1-p) )</td>
<td>( \begin{align*} A G_{I} &amp;= 0 \ A G_{II} &amp;= N(\beta^u - \beta^t) \left( \frac{1}{4} - p - \frac{p(1-p)(\beta^u - \beta^t)s}{2p(p-1)(\beta^u - \beta^t)s} \right) + \frac{18p^2 + 9p + 8}{64p^2} \end{align*} )</td>
</tr>
</tbody>
</table>

\( p, e, s, \sigma, \rho, \beta^u, \beta^t, \beta^s, \beta^t, \beta^s, \beta^t \) are decision parameters.
Appendix 1

The problem faced by ASL can be written as:

\[ \text{Min } t \]

s.t.

\[ C_i = c_i^b + q_i + \beta_i + x_j - e_i \quad i = l, h \]

\[ t - E(C_i - f(t)) \geq 0 \]

The inequality for the reservation utility of the hospital can be taken as an equality. The first constraints can then be substituted in the second constraints. The problem can be solved using the Lagrange approach:

\[ \text{Min } TR = t - \lambda [t - p(C_l - f(e_l)) + (1 - p)C_h - f(e_h))] \]

The F.O.C. for the problem can be written as:

\[ \frac{\partial TR}{\partial e_L} \quad \lambda \cdot [f'(e_L) - 1] = 0 \]

\[ \frac{\partial TR}{\partial e_H} \quad \lambda \cdot [f'(e_H) - 1] = 0 \]

\[ \frac{\partial TR}{\partial t} \quad 1 - \lambda = 0 \]

giving:

\[ f'(e_L) = f'(e_H) = 1 \]

\[ t - pC_L + (1 - p)C_H - f(t) = 0 \]
Appendix 2

Max \[ \Pi = \left( q - q_{PR} + E(\beta) - \beta_L \right) p \left( \frac{\phi}{2s} (q_{PR} - 0) + \frac{1}{2} \right) + \left( q - q_{PR} + E(\beta) - \beta_H \right) (1 - p) \left( \frac{\phi}{2s} (q_{PR} - \frac{3s}{4\phi}) + \frac{1}{2} \right) \]

s.t.
\[ q_{H} \geq 0 \]
\[ q_{L} \geq 0 \]

The F.O.C. can be written as:

\[ \frac{\partial \Pi}{\partial q_{H}} - p \left( \frac{\phi}{2s} (q_{PR} - 0) + \frac{1}{2} \right) + \left( q - q_{PR} + E(\beta) - \beta_L \right) p - \frac{\phi}{2s} \leq 0 \]
\[ \frac{\partial \Pi}{\partial q_{H}} - (1 - p) \left( \frac{\phi}{2s} (q_{PR} - \frac{3s}{4\phi}) + \frac{1}{2} \right) + \left( q - q_{PR} + E(\beta) - \beta_H \right) (1 - p) \frac{\phi}{2s} \leq 0 \]

(A2)

It can be shown that both equations cannot be verified as equality at the same time, i.e. a corner solution exists. Given that both groups of patients are interested only in a type of quality, the hospital will specialise in one of the two according to \( p \), the relative density of the two groups. The corner solutions can be easily evaluated from equation (A2) and are presented in the text.
Appendix 3

The problem can be written as:

Max $\frac{1}{2} + p \frac{\varphi}{2s} (q^\mu - 0) + (1 - p) \frac{\varphi}{2s} (q^\mu - \varphi) $

s.t.

$[q^s - q^\mu + E(\beta) - \beta_L] p \left\{ \frac{\varphi}{2s} (q^\mu - 0) + \frac{1}{2} \right\} + [q^s - q^\mu + E(\beta) - \beta_H] (1 - p) \left\{ \frac{\varphi}{2s} (q^\mu - \varphi) + \frac{1}{2} \right\} \geq 0$

$q^\mu \geq 0$
$q^s \geq 0$

The hospital has to concentrate on low cost patients to have a surplus that can be invested into increasing its share. It will henceforth set $q^M = 0$. However, this condition does not guarantee that no high cost patients will turn up; in fact N/8 of them will turn up producing a deficit equal to. Given this constraint the hospital will find $q^\mu$ that maximises the share of low cost patients:

Max $\frac{1}{2} + p \frac{\varphi}{2s} (q^\mu - 0)$

s.t.

$[q^s - q^\mu + E(\beta) - \beta_L] p \left\{ \frac{\varphi}{2s} (q^\mu - 0) + \frac{1}{2} \right\} + [q^s - q^\mu + E(\beta) - \beta_H] \frac{(1 - p)}{8} \geq 0$

$q^\mu \geq 0$
$q^s \geq 0$
References


Levaggi, R. and M. Montefiori (2005) It takes three to tango: cream skimming in the hospital care market, mimeo

Levaggi, R. and M. Montefiori (2005) Hospital care specialisation and PPS, mimeo


