Hospital budget constraint(s) and patients’ mobility: Evidence from Italy

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Abstract
Italian regional health authorities that are efficient in attracting patients take a great advantage from passive mobility. There are three main benefits for the hospitals of being able to attract patients from outside regions: ability to attract patients is a signal of the quality of the care for regional policy makers, hospitals are able to generate revenues on the top of the funds that are provided by the regional health care authorities and as a consequence they are less dependent on regional health care budgets (Levaggi Menoncin.2008). No study explored the effects of extra regional mobility at the hospital level and given that extra regional mobility help to balance hospital budget, absorb excess production investigating whether hospital engage in strategic incentives to attract patient inflows from other regions and in particular from southern poorer regions is a very topical research question.
Using longitudinal data on hospital discharges occurring over the period 2008-2014 in the private and public hospital in Lombardy we analyzed the consequences of decentralization on patient mobility at the hospital level. Three outcomes are measured and estimated in this empirical approach. First of all the length of stay, a typical indicator of efficiency but also an indicator of intensity of treatment. Secondly, waiting time for surgical admissions, a quality indicator that can be also used as a way to attract more patients. Finally, the reimbursement indicated in the hospital discharge chart that allow us to identify whether the extraregional patients are concentrated in DRGs where the reimbursement is higher compared to the patients living in Lombardy. As expected length of stay is shorter for patients living outside from Lombardy, but is longer if we consider the surgical admission. Waiting times results, as expected suggest that the patients living in a different region, wait less for an hospitalization compared to the patients living in Lombardy.
In particular results suggest that private hospitals are more extreme in this difference between Lombardy and not Lombardy patients with extra regional patients waiting significantly less than regional ones.
Overall and for surgical admission the hospitals tend to admit extraregional patients that lead to a higher reimbursement, while the medical admission have a negative coefficient. The ownership comparison confirms this results, even if for the public hospitals the results change. This means that the public hospitals decide to admit more complex patients living in other regions also for medical hospitalizations, that are avoided by private hospitals.

1. Introduction
There is increasing evidence that patients’ free choice between types of providers (public vs. private), and also across providers in different regional jurisdictions, enhances competition and improves the quality of health care services, and also allows a containment of costs ( Oliver &Mossialos 2005; Gaynor and Town, 2011; Gravelle et al., 2012).
Gravelle Santos and Siciliani (2014) show that hospital quality, measured using medical and patient reported indicators, is positively affected by the quality provided by other hospitals in the same market. The welfare effects of patients mobility across regions are however less clear. Brekke et al (2014) show that free patient choice may be beneficial for both patients from high and low skill regions. Patients from high skill regions receive benefits from high skill hospitals. With free mobility, low skill regional patients receive high quality care elsewhere. In the short run, free patient mobility is expected to penalize low skills regions by diverting economic resources from hospitals providing low quality care. In the long run, however, voluntary mobility is predicted to approach to zero because competition would provide a strong incentive to rise the quality of health care and stimulate quality improvements in the less efficient jurisdictions (Brekke et al. 2008, 2010, 2012). In line with these findings, free patient mobility combined with decentralization of health care provision are common features of many health care systems in European countries such as Italy, Sweden, UK and Germany. On the other hand, Brekke et al. (2016) shows that patients mobility may have countervailing effects on welfare when Regions with a different level of income compete.

Compared to other European countries, the process of decentralization of health care in Italy is more marked and for this reason patients mobility should be carefully studied. In 2001, the devolution of powers from central to regional authorities gave rise to 21 separate health care systems responsible for autonomously funding, organizing and delivering health care services. Within the European context, the Italian framework provides a unique opportunity to explore the effects of competition and decentralization on the quality of health care provided at regional and hospital level in a setting characterized by large jurisdictional differences in hospital capacity, technology endowment, income and financing ability.

The WHO has rated the Italian Health Care system been as one of the best health care system in the world. Italy’s life expectancy is the 4th highest among OECD countries with a per capita spending well below the average of other high income countries (OECD 2015). Despite this success, there are significant regional differences in the quality of the health care provided and in the health status of Italian citizens. Italy average life expectancy is 82.3 years, but this value, is not equal distributed across regions, and ranges from 83.5 years (81.2 for men and 85.8 for women) in Trento (Nord of Italy) to 80.5 years in Campania (78.3 for men and 82.8 for women) (South of Italy). A similar trend is also observed for the reduction in mortality over the last 15 years that has been reduced by 27% in the Nord; 22% in the Center and only 20% in the South. (Rapporto Osserva Salute 2016). Arguably, the differences can be associated with the unequal quality of the health care delivered. The average number of acute hospital beds, for instance, ranges from 2.6 per 1000 inhabitants in Calabria (South) to 3.8 in Friuli Venezia Giulia (Nord). A similar pattern is observed for waiting times (Rapporto Osserva Salute 2016). Waiting times for a
cardiological visits range from 42.8 days in the North to 88 days in the Center of Italy while for rehabilitation the waiting time is on average 13 days in the North East to 69 days in the South of Italy (Rapporto Osserva Salute 2016).

As described in previous studies, patient freedom to choose their health care supplier, within a context of fixed prices creates an incentive for regional jurisdictions, to lift quality and attract patients from other regions (Gaynord & Town 2012). In addition, given that patient inflows from other regions and levels of satisfaction are proxies for the quality in terms of efficiency and effectiveness of health care, regional authorities are also able to attract resources from other regions that need to reimburse their patients outflows. (Aggiungere dati del ministero sui flussi di mobilità)

The south to north pattern of patients mobility may be explained by disposable income. People living in wealthier regions (higher GDP per capita) that in principle would be more willing to move for a better quality of care are also those where public health expenditures are higher and with a low outflow mobility (Levaggi and Zanola 2004). These results are also confirmed by the study conducted by Fabbri and Robone (2010). Using gravity models, their analysis shows that patient flows move from poorer (south) to richer (northern) regions and in particularly for the most severe cases. The results also suggest that larger local health authorities have a better ability to contain patients outflow and to export hospital services. A subsequent study investigated the drivers of patients flow mobility in Italy using data on hospital admission from all the Italian regions (Balia et al. 2017). The study found that regional income, hospital capacity, organizational structure, performance and technology were the main determinants of patient cross border mobility.

The analysis by Brenna and Spandonaro sheds further light on whether competition between public and private providers affects cross border mobility using data for acute admissions in five regions with persistent high positive cross border mobility balances (Tuscany Lombardy Emilia Romagna Lazio and Molise).

According to Berta et al. 2011, public hospitals in Italy perform as well as the private ones; however, public providers are more efficient that private ones. Following these analyses one should expect to find the same attraction index of cross border patient for public and private hospitals (or a higher attraction index for public hospital). In contrast with these findings, Brenna and Spandonaro (2015) found that cross border patients are more likely to prefer private care. Confirming their hypothesis, the study found that the attraction index - measuring the ability of a selected region to attract patients from another region- is systematically higher for accredited private hospitals than for public hospitals. Since no differences in quality can be assumed between private and public providers of the same category of hospitals, this
finding suggests the presence of another variable - strategic incentives from the supply side – that influences patients’ preferences.

As pointed out by Balia et al. (2017) regional health authorities that are efficient in attracting patients take a great advantage from passive mobility. For example, through the revenues coming from passive mobility Lombardy and Emilia Romagna transformed their benefits in mobility gains. Additional benefits include increasing use of local accommodation and transport services and a good electoral feedback for regional authorities (Brenna and Spandonaro 2015). The strategic game that Regions can play using patients mobility have been furtherly analysed by Levaggi and Menoncin (2015) where a game is developed between poor/inefficient regions and rich/efficient ones. Through patients mobility and soft budget constraint policies both Regions maximize their short run utility at the cost of greater inefficiency. Given these existing incentives to limit the outflow of patients, and also to attract cross border patients, previous studies investigated the main drivers for efficient regions /local health authorities to attract cross border patients. However, no study investigated whether, and if so how, hospitals within the same region compete on quality of care to attract extra regional patients. There are three main benefits for the hospitals of being able to attract patients from outside regions: ability to attract patients is a signal of the quality of the care for regional policy makers, hospitals are able to generate revenues on the top of the funds that are provided by the regional health care authorities and as a consequence they are less dependent on regional health care budgets (Levaggi Menoncin.2008) No study explored the effects of extra regional mobility at the hospital level and given that extra regional mobility help to balance hospital budget, absorb excess production investigating whether hospital engage in strategic incentives to attract patient inflows from other regions and in particular from southern poorer regions is a very topical research question.

Using longitudinal data on hospital discharges occurring over the period 2008-2014 in the private and public hospital in Lombardy we analyzed the consequences of decentralization on patient mobility at the hospital level.

**Background: 21 Health care systems in one State**

The National Health Service (NHS) in Italy is founded on the principles of universal coverage and access to care based on need, not ability to pay. Created in 1978 the Italian Health Care system underwent to major reforms that, progressively shifted the supply of care from the central government to the 21 regional health authorities. Since 1999 there has been a progressive introduction of reforms to create an Italian internal market for health care services and the possibility for patients to receive care in any hospital in Italy. In 2001 a policy of devolution has transferred responsibilities from the central to regional governments. The 21 Regions have significant autonomy to organize the delivery of health services that meet the specific needs of their population. In the Italian NHS single regions are in charge of
planning and managing and funding through regional taxes (e.g. production tax, a percentage of the value added tax etc.); the health care services. The Italian central government is responsible for setting the minimum level of essential care that should be delivered to all Italian citizens (also referred as Livelli Essenziali di Assistenza). It is also responsible for redistributing financial resources via a system of intergovernmental grants (Fondo di Solidarietà), to allow poorer regions to deliver same set of services (constitutionally guaranteed) to citizens. In each region Local Health Authorities (LHAs) are in charge of providing health care services through public hospitals, private accredited hospitals and through the hospitals they directly manage. To promote hospital efficiency patients in Italy are free to choose the hospital within and outside their region. Hospital services are free of charge for all Italian patients independently form their region of residence. Care provided to regional resident is reimbursed by the LHA regional specific perspective tariffs that vary greatly between regions. Inter-regional flows are reimbursed by the LHA of residence using a national tariff (TUC, Balduzzi).

**The Lombardy system**

Lombardy is one of the largest Regions both in terms of population (10 million) and GDP. The health system comprises about 150 hospitals, treats about 1.7 patients per year and has a health expenditure of 18 billion Euros, which amounts to 75% of total regional public spending. A regional policy in 1997 radically transformed the healthcare system from an integrated system to a quasi-market in which purchasers are split from providers and citizens have free provider choice. In the Italian and international literature, the “Lombardy model” is always mentioned for its uniqueness, compared to the other Italian regional systems (Mapelli, 2000; Anessi Pessina et al., 2004; France et al. 2005; Brenna 2011). In 1997 with the regional law 31/1997 it was designed a quasi-market model with the aim of improving quality of care by increasing competition between public and private providers of health care and to contain health care costs (Brenna 2011; Berta et al. 2013).

Providers have to compete on quality under a prospective payment system based on Diagnosis Related Groups (DRGs). Each provider fixed DRG tariff based on patients diagnosis (eg heart attack) or procedure (eg hip replacement). NHS patients can receive treatment from public, private non-profit and private for-profit hospitals, though hospitals need to be accredited. Hospitals in Lombardy are reimbursed using a prospective budget that is assigned based on the historical cost at the beginning of the year. Although in principle the Lombardy case is a quasi-market model in practice there is not a complete free competition between public and private providers (Berta et al. 2016). As pointed out by Brenna (2011) the Region can intervene with ex-post funding directly from regional funds for those public hospitals which override their budget. The same is not applied to private hospitals that face a hard budget constraint and must comply with the tariff caps. This system of ex post funding (soft budget constraint) applied only to public hospitals not only creates distortions in the free competition between providers but
has also potential consequences for cross border mobility. The hospitalizations for patients living in other regions are reimbursed extra budget (outside the tariff caps) at the end of the year and this provides a strong incentive for private providers looking for additional source of revenues (Brenna 2007; Caroppo and Turati 2007).

Hospital Characteristics
We have selected a range of hospital characteristics that we expect to influence the patients’ choice to seek care outside their region. Besides distance, the most powerful driver of hospital choice should be the quality of care provided by the hospital. Quality of care is measured using both input and output measures. Among the input measures the number of doctors/nurses per beds as well as range of specialized services and the teaching status are the most commonly adopted (to further expand) (McNamara 2003; Tay 2003; Tai et al. 2004; Basu and Friedman 2001; Burns and Wholey 1992; Goodman et al. 1997; Fabbri and Robone 2010). Despite these variables indicate the efforts that the hospital is putting to improve its quality it is still possible that a wrong combination of good inputs produces a bad quality of care. The most commonly used output measures are the mortality rates, complications of the patients admitted to the hospital (Burns and Wholey 1992; Tay 2003). These two outcome variables are difficult to measure and can provide a biased source of quality measure (Tay 2003) especially for low volume hospital and for hospital attracting sicker patients. The possible solution for this outcome measure is to adjust them for the case-mix of the hospital.

Another variable often considered in the literature is hospital size (number of beds) however as pointed out by Varkevisser and van Geest (2006) this variable might create an endogeneity problem (it is not possible to establish the causality direction: bigger hospital are more likely to attract patients or high selection rates generate bigger hospital). Another main hindrance in the use of this variable is that it may be strongly affected by national or regional standards that impose ex ante the minimum number of beds required per 100 inhabitants.

Italian hospital should met the target set by the central government of 3 beds per 1000 inhabitants this is the bed population ration considered to be efficient by the Ministry of Health. An excess of hospital beds may be an indicator of bad quality however a higher capacity might have also positive effects such as shortening waiting lists. Finally given the number of inhabitants consider only regional patients is possible that efficient and high quality hospitals that are able to attract a high volume of extra regional patients may appear inefficient because of their larger capacity. As suggested by Montefiori 2005 when there are not public data available on the true clinical quality of the health care providers other measures that do not consider clinical quality but different elements of hospital experience become particularly relevant in the patient selection process. Length of stay and waiting time that are not traditional quality measure may strongly affect patients choice. In principle a shorter length of stay compared to the average
is a sign of a more efficient hospital treatment however from patient perspective, longer stays can be viewed as an insurance against bad health at home after admission and might be associated with a better (perceived quality) (Balía 2017). This becomes even more important for patients that needs to travel back to their regions and for those whose travel is particularly long. Another recently considered measure is waiting times that may be a relevant characteristic in determining the patient choice. According to previous studies low levels of waiting times are positively correlated with patient choices (Bessho 2003; Varkeviesser and van der Geest 2006).

**Empirical estimation**

In this section we present the estimated models and some preliminary results that support the interest in this paper.

First of all, we introduce the data used in the analysis. The data refer to hospitalizations in Lombardy (Italy) in the years 2010 to 2014, excluding patients under the age of 18. Only acute hospital admissions are considered.

The empirical approach is designed in order to analyze the differences between patients living in Lombardy and in other regions, and to do this all the models contain a variable identifying the region where the patient lives.

Models with inclusion of hospital fixed effects (not shown in the results tables) have been developed. The models include controls for the year of hospitalization, the seasonal effect identified by the month, the MDC of hospitalization, the comorbidities as identified by the Elixhauser algorithm. Additionally, models are adjusted for type of DRG (Surgical or Medical), age and sex of the patient and DRG weight.

In addition, a first set of models was estimated for all patients (patients living in Lombardy vs patients living in other Italian regions), and a second set of models was estimated to compare Lombardy patients with those from southern Italian regions.

Finally, a simple split approach has been performed in order to estimate and compare models on all hospitalizations, only on medical admissions and only on surgical admissions. By the way, the models concerning waiting times are estimated only on surgical hospitalizations.

Three outcomes are measured and estimated in this empirical approach. First of all the length of stay, a typical indicator of efficiency but also an indicator of intensity of treatment. Secondly, waiting time for surgical admissions, a quality indicator that can be also used as a way to attract more patients. Finally, the reimbursement indicated in the hospital discharge chart that allow us to identify whether the extraregional patients are concentrated in DRGs where the reimbursement is higher compared to the patients living in Lombardy.
For brevity, the covariates included in the models are omitted from the tables, where only the variable identifying the comparison between patients living in Lombardy and patients living in a different region is presented.

Table 1 presents the results for the three outcomes and the comparison for the overall admissions and the medical and surgical hospitalizations. Table 2, 3 and 4 present the ownership comparison for the three outcomes considered.

Table 1 shows as the length of stay is shorter for patients living outside from Lombardy, but is longer if we consider the surgical admission. This means that the hospitals tend to be more efficient when the hospitalization is medical, then it can be considered less risky. In case of a surgical admission the patient stay in hospital more than a patient living in Lombardy. This seems to indicate that the hospitals are more careful in the discharge when the patient live far from the hospital. But this result is interesting in the ownership comparison, because it shows that the private for profit hospital tend to maximize their profit ignoring the distance between the hospital and the place where the patient live. In fact, in table 2 we can observe that Public and not for Profit hospitals have a positive and significant coefficient, whereas the Private for profit have a negative coefficient even for the surgical hospitalizations.

The second outcome analyzed in table 2 is the reimbursement. Overall and for surgical admission the hospitals tend to admit patients that lead to a higher reimbursement, while the medical admission have a negative coefficient. The ownership comparison confirms this results, even if for the public hospitals the results change. This means that the public hospitals decide to admit more complex patients living in other regions also for medical hospitalizations, that are avoided by private hospitals.

The last outcome presented in table 1 is the waiting times, where, as expected, the patients living in a different region, wait less for an hospitalization compared to the patients living in Lombardy.

Table 4 confirms the result, and shows as the private hospitals are more extreme in this difference between Lombardy and not Lombardy patients, as indicated by the magnitude of the coefficients.

### Table 1: Models for patients living in Lombardy and patients living in a different region

<table>
<thead>
<tr>
<th>Dep Variable:</th>
<th>Covariate</th>
<th>Overall</th>
<th>Medical</th>
<th>Surgical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Stay</td>
<td>Extraregion vs Lombardy</td>
<td>-0.009***</td>
<td>-0.055***</td>
<td>0.036***</td>
</tr>
<tr>
<td>Reimbursement</td>
<td>Extraregion vs Lombardy</td>
<td>0.064***</td>
<td>-0.026***</td>
<td>0.110***</td>
</tr>
<tr>
<td>Waiting Times</td>
<td>Extraregion vs Lombardy</td>
<td></td>
<td></td>
<td>-0.098***</td>
</tr>
<tr>
<td>Observations</td>
<td></td>
<td>4,902,225</td>
<td>2,494,224</td>
<td>2,408,001</td>
</tr>
</tbody>
</table>

### Table 2: Models for Length of Stay - Ownership Comparison (Lombardy vs Other Regions)

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Overall</th>
<th>Medical</th>
<th>Surgical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraregion vs Lombardy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overall Extraregione vs Lombardo</td>
<td>Public Extraregione vs Lombardo</td>
<td>Private Extraregione vs Lombardo</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------</td>
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<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td>-0.009***</td>
<td>0.016***</td>
<td>-0.019***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.055***</td>
<td>-0.041***</td>
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<td></td>
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**Tabella3: Reimbursement - Confronto per Ownership**

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Overall Extraregione vs Lombardo</th>
<th>Medical Extraregione vs Lombardo</th>
<th>Surgical Extraregione vs Lombardo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>0.064***</td>
<td>-0.026***</td>
<td>0.110***</td>
</tr>
<tr>
<td>Public</td>
<td>0.045***</td>
<td>0.020***</td>
<td>0.066***</td>
</tr>
<tr>
<td>Private</td>
<td>0.103***</td>
<td>-0.074***</td>
<td>0.145***</td>
</tr>
<tr>
<td>Not for Profit</td>
<td>0.019**</td>
<td>-0.063***</td>
<td>0.072***</td>
</tr>
</tbody>
</table>

**Tabella4: Waiting Times - Confronto per Ownership**

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Surgical Extraregione vs Lombardo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>-0.098***</td>
</tr>
<tr>
<td>Public</td>
<td>-0.063***</td>
</tr>
<tr>
<td>Private</td>
<td>-0.122***</td>
</tr>
<tr>
<td>Not for Profit</td>
<td>-0.090***</td>
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