The Role of Persistence in Extracting a Signal of Hospital Quality for Italian Regions

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FIRST DRAFT

Abstract

Hospital quality measures are increasingly being used in the public domain to compare hospitals and constitute one of the main drivers of hospital choice at least for elective pathologies. Therefore, an investigation of hospital quality across Regions is fundamental to forecast patients' mobility and address the intervention of the policymaker.

The aim of this paper is to revisit the two-step methodology proposed by Papanicolas and McGuire [2017] and apply it to the data of the Piano Nazionale Esiti (PNE) for the years 2008-2016 to reach the following extents. The first is to extract regional fixed effects from yearly cross-sectional hospital-level data for three standard health quality measures for acute myocardial infarction (30-day mortality rate, 365-day readmission rate and the ratio of 30-day crude rate mortality for treated with PTCA versus not treated). The second is to smooth the fixed effect obtained in the first step through a vector auto-regression estimated over time in order to forecast the future quality of the regional healthcare systems in Italy.

Combining information from different time periods and across hospitals allows us to produce robust regional quality measures and predict the regional quality of healthcare in the Italian setting.

JEL Classification: H75, H77, I11, I14

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1 Introduction

An instructive and widespread aphorism is the following: "A data becomes information when it is able of changing the probability of decisions". This is true in several contexts but it applies very well to the case of healthcare. The lack of good information on performance or quality, in fact, is a core problem in many areas of public policy and evaluation today. The difficulty of developing reliable information on the quality of health care providers for guiding public policies and individual choices is perhaps the most striking example. Availability of reliable measures of hospital quality (henceforth: HQM) is important because they affect how individuals take health decisions (i.e. hospital choice). In fact hospital quality drives individuals' hospital choice together with other factors like distance (time and cost of transportation), waiting time, etc. In Italy, where the hospital quality measures are not widespread, in order to understand the individuals' hospital choice it could be useful to analyze the quality of the national health system at an aggregate level. The goal of this research is to consider a range of health outcome measures related to heart disease over time to develop and implement statistical techniques to extract a signal of health quality for Italian regions, smoothing standard health quality measures across hospitals and across years. We adapt vector autoregression (VAR) methods for panel data to estimate the systematic relationship across outcomes and over time at regional level, and then use this information to forecast future outcomes and to filter out much of the noise in the observed outcome measures. All of the dimensions of quality that we consider - multiple quality measures, and multiple time periods- are likely to be related to each other in hospitals of the same region, and so can aid the extraction of the signal for each region. Our scope is that these adjusted signals of quality would enrich the awareness of the differences in the quality of healthcare across regions and help explaining patients' mobility.

2 The Italian National Healthcare System

The WHO rated the Italian Health Care system as one of the best in the world. Italy's life expectancy is the 4^{th} highest among OECD countries with a per capita health care spending well below the average of other high-income countries (OECD (2017)). Despite this success, there are significant regional differences in the quality of health care and, as a consequence, in the health status of the Italian citizens. For example, average life expectancy is 82.3 years, but this value ranges from 83.5 years (81.2 for men and 85.8 for women) in Trento (North of Italy) to 80.5 years in Campania (78.3 for men and 82.8 for women) (South of Italy). A similar trend is observed for the reduction in mortality over the last 15 years: 27% in the North; 22% in the Centre and only 20%in the South (Osservasalute (2016)).

To understand the reasons behind these regional differences it is important to describe the characteristics of the Italian national health system from its origins and through the reforms that have contributed to making it as it is now.

The National Health Service (NHS) was established in 1978 (Art.1, L. 833/1978) and is composed by a system of institutions, both public and private, highly complex. The main principles on which the law of healthcare reform is founded are the following:

- universality of the right of health assistance for all people and all kinds of illness, without any discrimination;
- management of the supply of services committed to the U.S.L./A.S.L.;
- equality of citizens and uniformity of the treatment in all the country.

The National Health Service was deeply reformed in 1999 (Art., Decree Law 229/1999) when it was transformed in a regional system giving a new role and responsibility to the regions. The central government has the responsibility of legislating, establishing the minimum level of assistance, programming the healthcare policy and partially financing the national health service possibly intervening in the case of excessive deficit of regions.

The regions, according to the Italian Constitution (Art. 117), have competence on the healthcare assistance on their territories, the responsibility of legislating within the framework of fundamental principle established by the central government, the faculty of collecting the regional taxes using them to finance the local health districts (which correspond to the ASL or aziende sanitarie locali). Focusing on the organization of the National Health Service, the local health districts and the hospitals operate at a local level. The ASL have the responsibility to supply healthcare services to the population of a given territory (district), directly with their own structures or through private suppliers, to organize and program the development of services and to allocate resources to the latter. On the other side, the hospitals are large structures, financed by A.S.L., whose primary functions consist in making the activities of recovery of patients and offering specialized cares.

2.1 Regional healthcare systems

Since the ASLs are the institutions in charge of providing healthcare services to citizens, an important decision that has to be made by regional governments is in how many ASLs to divide their territory. Some Regions prefer to have many small ASLs: this is, for example, the choice of Veneto, which currently has about twenty ASLs, with an average population of 235,000 inhabitants. Other regions have instead decided to have few larger ASLs: in Campania, for example, the seven local health authorities have an average population of around 837,000 inhabitants. The Marche has even set up a single regional healthcare company, which takes care of over 1,500,000 residents. This is also the direction of the recent reforms of the Umbria Region, which in 2012 has reduced the number of ASLs from 4 to 2, or of the Tuscany Region, which has reduced the number of ASLs from 12 to 3. This decision is often driven by the aim of exploiting scale economies to improve efficiency.

In addition to the dimensions of the ASLs, the Regions can choose whether to leave the hospitals under the management of the ASL or transform them into autonomous hospital companies. In this regard, two models can be distinguished: the integrated one and the separate one. In the integrated model, hospitals remain under the control of the ASL: this should favor the coordination between hospital and territorial care. In the separate model, hospitals are instead separated from their respective ASLs and transformed into autonomous companies: this model, stimulating competition between the different hospital structures, reflects more the theoretical model of the "internal market". In our country, only one Region has adopted with conviction the separate model: Lombardy. All other regions have either an integrated system or at most a mixed system (as in Piedmont). In this case the discussion underlying the decision of adopting one system rather than the other is on the positive or negative effect of enhancing the competition in the healthcare sector (inserire riferimenti bibliografici es. Gaynor).

A further strategic choice that regional governments must make concerns the involvement of private health. Each Region is in fact free to decide which part of the services to provide with its own facilities and with its own staff, and which to outsource to private suppliers (nursing homes, private clinics, staff not employed by the NHS). The regions that mostly use private individuals are Lazio, Lombardy and Puglia (they outsource more than 40% of regional health expenditure). Instead, the

Province of Bolzano, Valle d'Aosta, Friuli-Venezia Giulia, Umbria and Tuscany have an eminently public supply structure (less than a quarter of public health expenditure is outsourced). In general, the southern regions make more use of private suppliers than the central-northern regions do.

The Regions enjoy wide discretion in reference to many other relevant issues, not only concerning the organization but also the financial management of the healthcare system. For example, each Region is free to fix the tariffs through which to repay the suppliers (both public and private) independently. Tickets also change from region to region. Consider for example the ticket on drugs: in some regions it is not provided, in others it consists of a fixed quota, in others it is modulated based on income. So for the same pharmaceutical prescription you can pay 8 euros in Tuscany, 4 euros in Lombardy, 2 euros in Calabria, a 1 euro in Trento; in Friuli, Valle d'Aosta, Marche and Sardinia you pay nothing.

2.2 The financial sources of the Italian Healthcare System

The Italian law determines annually the overall level of the resources of the National Health Service (NHS) funded by the State. The standard national health requirement is determined, by agreement, in line with the overall macroeconomic situation and in compliance with public finance constraints and the obligations assumed by Italy in the European Union, coherently with the needs deriving from the determination of the essential assistance levels (LEA) provided in conditions of efficiency and appropriateness. The amount allocated to the ordinary statute regions and the quotas destined to institutions other than the regions are distinguished. The financing of the NHS was designed by Legislative Decree 56/2000 which provided for a system of financing of the NHS based on regional fiscal capacity, even if corrected by appropriate equalizing measures, establishing three sources of revenues: IRAP, the regional supplement to IRPEF (the personal income tax) and a quota of VAT.

The needs for the healthcare system are therefore financed by the following sources:

- revenue of the NHS bodies (tickets and revenues deriving from the intramoenia of their employees);
- general taxation of the regions: IRAP (in the revenue component destined for health) and regional additional tax for IRPEF. General taxation, in its distinct IRAP and additional personal income tax components, passes through the Treasury accounts. The resources relating to the two taxes are paid to the regions each month in full (decree law 112/2008, article 77-quater);
- co-participation of the Regions with special statutes and of the autonomous Provinces of Trento and Bolzano: these institutions participate in health financing up to the requirements not met by the sources mentioned in the previous points, except for the Sicilian Region, for which the co-participation rate it has been set since 2009 to the extent of 49.11% of its health needs (law n. 296/2006 article 1, paragraph 830);
- National budget: it finances the health needs not covered by other sources of funding essentially through the sharing of value added tax - VAT (destined for regions with ordinary statutes), and through the National Health Fund (a quota is allocated to the Sicilian Region , while the rest also finances health costs linked to certain objectives).

The fact that the health system is financed by regional revenues is one of the factors that can contribute to determining and explaining the gap between regions.

2.3 Regional and macro area performance gap: differences between healthcare systems

Each Region has its own rules and its own organizational structure. The analysis of the relationship between alternative Regional approaches and the healthcare quality provided is crucial in order to understand if there is a model - at least on paper - better than the others. If we look only at the organizational model, and not at the results it produces, it is not easy to answer that question. For example, consider the question of the size of ASLs: it is not clear whether it is better to have small ASLs or large ASLs. There is no agreement among the experts on the optimal size of a healthcare company, and there is no solid empirical research that sheds light on the issue. But if we investigate the results produced by each healthcare system is possible to make comparisons between them. Indeed, individual regional health systems perform very differently. And a clear gap emerges between the north and south of the country.

The most critical aspects regard the financial balance, a source of constant friction between the national government and regional administrations.
In fact, few regions have been able to keep their accounts in order; among these are Friuli-Venezia Giulia, Lombardy, Veneto, Emilia-Romagna and Umbria. Other regions have systematically breached the budget. From 2001 onwards the regional health systems have accumulated a total deficit of almost 38 billion euros. However, the central and northern regions were responsible for just 13% of these losses. Central and southern regions (including Lazio) have accumulated over 87% of the

deficit. The central-northern regions, from 2001 to 2014, have on average accumulated a deficit of Euros 139 per capita. The deficit of the southern regions - always per capita, and always in the same time frame - was instead of well 1235 Euros: almost nine times higher than that of the central-northern regions. The absolutely most unruly regions were Campania and Lazio, which - alone - are responsible for 57% of the total health debt.

However, it is reductive to evaluate the goodness of a health system in economic terms; the focus of this research is on the state of health of the population and the quality of the services offered. But it is precisely here that the clinical picture becomes more complicated. The Ministry of Health, for example, monitors each year the extent to which the Regions are able to provide the essential levels of assistance (LEA) through the Piano Nazionale Esiti (PNE) program (See Section 3). The latter constitute the package of care we are all entitled to and which should be provided uniformly throughout the entire national territory. From the monitoring of the ministry it emerges how the Central-Northern Regions manage well (from a couple of years the first positions of the ranking are occupied - in order - by Tuscany, Emilia-Romagna and Piedmont); those of the South occupy the last positions of the ranking.

A recent study by C.R.E.A. Health1 provides a multi-dimensional assessment of the performance of individual regional health systems. Also here: the central-northern regions are all in the upper part of the ranking, the southern ones in the lower part. Many other indicators of efficiency or appropriateness could be considered. For example, the National Outcomes Program edited by AGENAS (National Agency for Regional Health Services), or the "targets" of Sant 'Anna di Pisa come to mind. The situation unfortunately does not change: all the rankings agree that in Italy we have higher quality health services in the Center-North and a lower quality health care, sometimes much lower, in the South.

2.4 Healthcare quality and patients' mobility

Citizens are aware of this gap in performance between Regional healthcare systems. As emerges from the last Censis Report on the social situation of the country, 83% of the inhabitants in the South considers their regional health service "not adequate". This percentage is much lower in the northern regions: in the North-East the dissatisfied are in fact 35%, in the North-West less than 30%.
It is therefore not surprising that residents in the southern regions - when they can - go and seek treatment elsewhere. This is the well-known phenomenon of healthcare mobility: every year about half a million patients are hospitalized in a region other than that of residence. Also on this front, the North-South imbalance is evident. For every patient residing in the Center-North who is admitted to a hospital in the South, there are six who make the reverse journey, or rather from the southern Regions go to be treated in hospitals in the Center-North.
Lombardy, Emilia-Romagna and Tuscany are particularly attractive. From other regions, patients tend to flee: this is especially the case in Calabria, Campania and Sicily. All southern regions, with the exception of Molise, have a negative health mobility balance.

A deeper understanding of regional disparities - based not only on a mere comparison between indicators but by splitting the temporal component - can provide useful policy indications to manage the mobility flows of patients with requests for elective services and push the Ministry of Health to invest extraordinary resources in the health systems of the regions with a worse quality, also exercising a more accurate control on the use of the allocated resources. In the next sections we will describe the dataset and the empirical model used to isolate the persistence effect and evaluate regional performance with more accuracy.

3 Dataset

The National Outcomes Program (Piano Nazionale Esiti, PNE) is a tool for measuring, analyzing, evaluating and monitoring the clinical-welfare performance of health facilities available to the Regions, companies and professionals for continuous improvement of our NHS. The results of PNE, activities that AGENAS carries out on behalf of the Ministry of Health, are published annually on the dedicated website. The indicators used to analyze the results of treatments, scientifically validated at international level, are aimed at achieving the following objectives:

- Continuous improvement of efficacy and appropriateness of care
- Greater equity of access to services of proven efficacy throughout the national territory, regardless of the area of residence
- Transparency and empowerment of citizens and associations, with the dissemination of clear and scientifically validated information
- Internal and external audit to identify possible critical issues in the quality of the data and in the clinical and / or organizational processes

3.1 The role of indicators

The process that leads to the definition of an outcome indicator starts with a systematic review phase of the scientific medical literature related to the treatment or therapeutic diagnostic path to be evaluated. The information derived from this first revision phase allows defining a first version of the protocol to be used to carry out the preliminary analyzes that will allow to verify the validity of the indicator. The indicators are documented by protocols with explicit definition of the outcome in the study, of the selection criteria of the cases, of the follow-up times, of the data sources and of the factors used for the risk-adjustment. The indicator protocol and the results of the preliminary analyzes are subject to evaluation by representatives of the scientific societies of reference, of panels of expert clinicians and further discussed within the PNE Committee. The outcome indicators measure the outcome of a care process in terms of clinical outcomes (eg mortality, morbidity, hospitalization). Their relationship with the measured phenomenon is influenced by various determinants that are not directly correlated with the quality of the care process (risk markers, environmental factors, socio-economic variables) and which must be considered and possibly corrected during the calculation of the indicator . The robustness of the outcome indicators also depends on the time between the measurement and the actual delivery of the health service. Process indicators measure the degree of adherence of the care process to the reference standards of the best clinical practice based on evidence. For this reason they are considered proxies for the outcomes of assistance and their robustness, understood as predictive of clinical outcomes, depends on the strength of the clinical recommendation and the degree of evidence on which they were built. In addition, indicators that report volumes are calculated, for health interventions for which scientific evidence of the effectiveness of association between activity volumes and treatment outcomes is available.

3.2 Data sources

The data sources used for calculating the indicators are the Health Information Systems (Sistemi Informativi Sanitari, SIS) and the administrative sources for their accessibility and for their ability to provide information on the totality of health care provided by health facilities operating within the SSN. Furthermore, the use of these information sources allows systematic monitoring over time of the indicators included in the PNE. Currently, the hospital information system (Sistema Informativo Ospedaliero,SIO) is used, which collects information on all hospital admissions (acute and post-acute) for each patient discharged from public and private institutions throughout the national territory validated through the linkage with data from the hospital tax register (Anagrafe Tributaria, AT). Data derived from electronic archives are integrated through record linkage techniques with the aim of integrating the information present in different archives or in the same archive in different periods.

3.3 Health quality measures in the analysis

In recent years PNE has constantly increased the number of indicators, assessed and selected. In particular, they increased in the angiological, orthopedic and pediatric area, going from 146 in 2015, to 165 in 2016, up to 166 indicators in 2017 (67 outcome and process *, 70 volumes of activity and 29 hospitalization indicators). For this analysis, we exploited the following cardiovascular indicators belonging to the PNE:

- Acute Myocardial Infarction: 30 days mortality
- Acute Myocardial Infarction without PTCA: 30 days mortality
- Acute Myocardial Infarction with PTCA within 2 days: 30 days mortality
- Acute Myocardial Infarction with PTCA later than 2 days from recovery: 30 days mortality
- Acute Myocardial Infarction: percentage of treated with PTCA within 2 days

- Acute Myocardial Infarction: 365 days readmission rate (MACCE)
- Acute Myocardial Infarction: percentage of treated with PTCA within 7 days

In the PNE, risk adjustment techniques are used which consist in the construction of a measure of gravity that describes the "clinical complexity" of the patient, based on the characteristics of the registry, the severity of the pathology in study and the concomitant pathologies of the patients, and in the use of such measure to obtain risks and adjusted relative risks, which allow a valid comparison between hospitals. Italian hospital performance is considered over the period 2008-2016. This gave an average of 82.421 cases each year for 283 hospitals involved in treating the AMI patients. We decided to exclude from the regional analysis hospitals located in Regions with special statutes, assuming that due to the different financial funding (see Section 2.2), their regional healthcare systems are not comparable to those of the other regions. Without regions with special statutes, we have 276 hospitals for 80,479 cases each year.
The descriptive statistics are reported in Table 3 and Table 4, for the same statistics with the inclusion of the Regions with special statutes see Table 9 and Table 10 in the Appendix. Table 2 shows the 30-day mortality, the 365-day readmission and the ratio of 30-day CRM for treated w/PTCA versus not treated for the sample of hospitals across all years (for the first two HQMs reported per hundred deaths or readmissions).

Table 1: Summary Statistics of the Sample

Condition	*Codes*	*Years analyzed*	*Mean cases per year*	*Number of hospitals*
AMI	Italian classification code: ICD-9-CM 410.xx	2008-2016	80,479	276

Table 2: Hospital Quality Measures

Condition and year	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
AMI 2008	11,64 (6,86)	26,54 (5,28)	1,74 (.31)
AMI 2009	10,51 (3,38)	25,48 (5,08)	1,79 (.34)
AMI 2010	10,86 (3,91)	25,23 (5,94)	1,82 (.32)
AMI 2011	10,62 (5,16)	24,45 (5,40)	1,84 (.34)
AMI 2012	10,06 (5,05)	23,32 (5,86)	1,86 (.37)
AMI 2013	9,12 (3,21)	22,88 (5,54)	1,83 (.36)
AMI 2014	9,11 (3,27)	-	1,89 (.34)
AMI 2015	8,97 (3,42)	21,52 (5,71)	1,90 (.42)
AMI 2016	8,28 (3,27)	-	1,95 (.44)

Table 3: Regional Characteristics V3:Esclusione regioni a statuto speciale

Region	*Number of hospitals*	*Number of districts*	*Mean cases per year*
Abruzzo & Molise	9	5	2,486
Campania	36	5	9,209
Emilia Romagna	25	9	10,365
Lazio	28	5	8,671
Liguria	9	4	3.138
Lombardia	50	12	15,248
Marche	2	1	640
Piemonte	24	8	7.626
Puglia	26	6	5,628
Toscana	22	10	7,952
Umbria	7	2	1.946
Veneto	38	7	7,181
Total	276	74	80,479

Table 4: Macro Area Characteristics V2:Esclusione regioni a statuto speciale

Macro Area	*Number of hospitals*	*Number of districts*	*Number of regions*	*Mean cases per year*
Nord	146	44	5	45,500
Centro	59	18	4	19,209
Sud	71	17	8	17,712
Total	276	74	17	80,479

4 The Empirical Model

The objective of this study is to return a reliable regional health quality measure (HQM) to investigate heterogeneity in healthcare provision in Italy at three levels of analysis:

- Hospital level
- Regional level
- Macro Area level

Since the health quality cannot be assessed directly, the valuable information on this measure can be returned through a two-step smoothing procedure (McClellan and Staiger (1999)). According to the data availability, at the hospital level only the second step of the smoothing procedure has been performed, while at the regional and macro area level we procede following the complete procedure.

4.1 First step: Fixed-effects estimation

The first step of our analysis uses three unadjusted health outcome measures (30-day mortality, 365-day readmission rate and treatment with PTCA within 2 days) for the acute myocardial infarction (AMI) at hospital level and adjusts them for risk through linear regression against hospital's and district's characteristics.

The following first-stage, risk adjustment regression equation is run on each of the hospital's HQM for each year of the analysis through ordinary least squares separately:

$$Y_{hr} = \mu_r + V_{hr} + P_{dr} + u_{hr} \quad (1)$$

where Y represents the HQM, h indexes the hospital and r the region to which the hospital belongs, V is a control for the volumes treated in the hospital and P represents the population over 55 years old in the district to which the hospital belongs.

Note that the μ_r in model (1), estimated through the incorporation of dummy variables, are of greatest interest as they return a regional fixed effect, which can be considered a proxy measure of regional hospital quality. These μ_r are, therefore, estimates of regional health quality for each of the three HQM gained through risk adjustment for hospital's and district's characteristics. As noted, equation (1) is run separately for each of the 9 years and for each of the three HQMs.

The regional fixed effects, returned from each of the yearly regressions, are used to construct a new vector, Q_r, of risk-adjusted regional quality, for each of the three HQM analyzed.

Assuming T yearly time periods and K measures of quality, the hospital quality vector Q_r, which is constructed from each of the yearly regressions, has dimensions K. In our case with 3 measures of quality and 9 years of observations over the period 2008-2016, the vector Q_r has dimension 1×27 .

The vector Q_r is then assumed to represent the following relationship to the true regional health quality:

$$Q_r = q_r + \epsilon_r \quad (2)$$

where q_r represents the $1 \times TK$ vector of the 'true' underlying quality for region r, and ϵ_r is the estimation error (which is assumed to have mean 0 and to be uncorrelated with q_r).

Thus, equation (2) assumes that the estimated risk-adjusted regional fixed effects Q_r are suitable predictors of true quality, and anything that is not captured by these estimates is incorporated in the error term ϵ_r .

It is the removal of the error term ϵ_r from the estimated regional fixed effects Q_r which allows further improvement in the measures. The error term ϵ_r is related to the hospital level regressions (equation (1)), in particular, to the variance-covariance (the matrix of the regional fixed effects obtained by ordinary least squares estimation of equation (2)) of the regression estimates Q_r, i.e.

$$E[\epsilon_r' \epsilon_r] = S_r \tag{3}$$

where S_r represents the variance-covariance matrix of the regional effects estimates for region r for each year obtained by ordinary least squares estimation of equation (1) with the normal assumption that the off-diagonal elements of the covariance of the disturbances are all equal to 0.

Since the true latent regional quality measure q_r is not directly observable, adapting the McClellan and Staiger (1999) method, it is possible to create a linear combination of each regional observed risk-adjusted measure of quality for each year, in such a way that it minimizes the mean-squared error of the predictions. This could be conceptualized as running the following (hypothetical) regression for each year:

$$q_r = Q_r \beta_r + \omega_r \tag{4}$$

They noted, however, that equation (4) cannot be estimated directly, precisely because q_r represents the true unobserved quality for the defined outcomes, in each region r for each year. Assuming K measures of quality and T years, note that Q_r

is a $1 \times TK$ vector and the optimal β for each quality measure k varies by hospital and year, given equation (2). The measurement challenge is to return the true hospital quality q_r for each quality measure k in each year, from the noisy estimate Q_r. We exploit McClellan and Staiger(1999) and Jones and Spiegelhalter (2012)'s insight that, although equation (4) cannot be estimated directly as q_r is not observed, the parameters of the hypothetical ordinary least squares regression represented by equation (2) and equation (4) can be retrieved from the existing data on the basis of the specified relationship between unobserved latent quality, observed quality and the error terms. In particular, the minimum least squared estimate, for each of the k quality measures over each of the t time periods, can be given by:

$$E(q_r|Q_r) = Q_r\beta \tag{5}$$

where:

$$\beta = E(Q_r'Q_r)^{-1}E(Q_r'q_r) \tag{6}$$

This best linear estimate can be returned by using the definitions:

$$E(Q_r'Q_r) = E(q_r'q_r) + S_r \tag{7}$$

$$E(Q_r'q_r) = E(q_r'q_r) \tag{8}$$

where $E(Q_r'Q_r)$ is the expected value of the products and cross-products of the regional fixed effects, which is gained from the first-stage hospital level regressions, and where $S_r = E(\epsilon_r'\epsilon_r)$ is the variance-covariance matrix of the disturbances that are associated with these fixed effects, which again is constructed from the first-stage hospital level regressions. $E(q_r' q_r)$ can be estimated by rearranging equation (7) such that $E(Q_r' Q_r - S_r) = E(Q_r' q_r)$. Subsequently equation (8) becomes $E(Q_r' Q_r - S_r) = E(q_r' q_r)$. Using these estimates and equalities, and inserting the relevant estimates into equation (6) allows derivation of the desired least squares parameters in equation (4). The q_r can then be easily estimated by region for each year by using observed values.

$$\hat{q}_r = Q_r E(Q_r' Q_r)^{-1} E(Q_r' q_r) = Q_r \{E(q_r' q_r) + S_r\}^{-1} E(q_r' q_r) \tag{9}$$

4.2 Second step: the Vector Autoregression

A further step in this smoothing procedure is represented by equation (10). This further step utilizes the information across the different time periods to improve these risk-adjusted, filtered quality outcome measures additionally. Hence the method can be considered a form of bidirectional smoothing estimation, where the measures can reduce noise within regions, and across time periods. This is undertaken by using a vector auto-regression (VAR) model, with further structure imposed on the filtered quality estimates by assuming that each quality measure is reflective of its past performance, plus a contemporaneous shock that may be correlated across the different outcome measures. Noting that we have K measures of quality, which are interrelated and contain signals from past performance, and T years a first-order VAR model is specified to return the estimate $\hat{q}_{rt}$ for each of the k measures of quality. The estimate $\hat{q}_{rt}$ is a $1 \times K$ vector derived from estimating the auto-regressive process

$$\hat{q}_{rt} = \hat{q}_{r,t-1} \Phi + \hat{q}_{r,t-2} \Phi' + v_{rt} \tag{10}$$

where Φ is the $K \times K$ matrix containing the estimates of the first lag coefficients of each of the HQMs and Φ' is the $K \times K$ matrix containing the estimates of the second lag coefficients of each of the HQMs.

Using the parameters that are estimated from the VAR model, we can estimate equation (10) to return non-stochastic smoothed estimates of quality for each region, incorporating the times series data; in this way the smoothing process has been applied to our measures bidirectionally, across waves and across hospitals. McClellan and Staiger (1999) referred to the results obtained through this two-step smoothing procedure as "predicted" estimates, while Papanicolas and McGuire (2016) adopted the term (bidirectional) smoothed estimators.

In addition to the implementation of the VAR procedure to the fixed effects obtained as result of the first step of the analysis, we tested the same specification at hospital level. The specification obtained is the following:

$$q_{ht} = q_{h,t-1}\Phi_h + q_{h,t-2}\Phi'_h + v_{ht} \tag{11}$$

The relevant value of this second step of the procedure, which consists in the application of the VAR, is that it allows the further production of forecast measures of healthcare quality. This is is of main interest to researchers and policy makers in particular at the regional level because it can offer insights about future mobility across hospitals driven by regional healthcare systems' quality. Moreover forecast measures can give useful policy indications: i.e. regions in which should be allocated more resources to enhance the healthcare quality and reach national standards. We will discuss these aspects related to policy implications in Section scrivi.

5 Results

We applied the two-step methodology described above to data on the three Health Quality Measures (30-day mortality rate, 365-day readmission rate and the ratio of 30-day crude rate mortality for treated with PTCA versus not treated) focusing on the treatment of AMI. We applied the first step of the methodology to the hospital data to extract a signal of quality for each region and each macro area. In the second step of the methodology, we applied the vector autoregressive model to data at three levels: the hospital level, considering each hospital as an individual record; the regional level, considering for each region the fixed effect obtained in the first step and its temporal lags; the macro area level, considering for each macro area the fixed effect obtained in the first step and its temporal lags.

5.1 Results of the first step

5.1.1 Regional fixed effects

The first step of the methodology has been used to extrapolate a regional and a macro area fixed effect from hospital data for each of the Health Quality Measures. Results of the regional fixed effects are reported in Table 5. As can be read in Table 5 and also seen from Figure 1, the regions which show a lower 20-day mortality rate - colored in dark blue - are: Emilia Romagna, Toscana, Marche, Lombardia and Piemonte. A 30-day mortality rate higher than 10%, associated with a worse health quality, characterizes three regions of the South of Italy: Abruzzo, Molise and Puglia.

Looking at the second Health Quality Measure - the 365-day readmission rate - the regions with the lowest level of readmission are Lazio and Piemonte, whereas the ones with highest rate od readmissions are Abruzzo, Molise and Lombardia. The regional distribution of the readmission rate is represented in Figure 1, where regions with a lower readmission rate are colored in dark blue while in white there are those with the higher levels. Although readmission rates are a popular health quality measure, with higher emergency readmissions in particular thought to be indicative of worse quality, it cannot always be attributed to the overall quality of care delivered by the hospital (Fischer et al., 2012). McClellan and Staiger (1999) and Laudicella et al. (2013) noted that high readmissions may not signal poor quality when hospital treatment is lowering mortality rates and more severely ill patients are surviving initial disease episodes. Under such circumstances higher readmission rates might be expected. Moreover, readmissions may reflect poor quality care in other parts of the healthcare system (e.g. the primary care sector), or individual behavioral factors beyond hospital control (e.g. poor adherence to medicines). Benbassat and Taragin (2000) concluded that readmission indicators are not good measures of quality of care for most conditions, as there is large variation in the percentage of this indicator that can be attributed to poor quality care. Their own study, using different readmission indicators for a range of conditions, estimated the variation for readmissions associated with improved quality of care to be between 9% and 50%. They did note that readmissions for specific conditions, such as childbirth, coronary artery bypass grafting and acute coronary disease, as well as approaches that ensure closer adherence to evidence-based guidelines, may provide more appropriate measures of quality. However, after initial use in the USA, there are now a growing number of European countries which employ readmission rates as a health service outcome measure (Klazinga, 2011) and attach financial incentives to them (Kristensen et al., 2015). For this reason we decided to include this health quality measure that is intended to be evaluated together with the trend of the crude mortality rate.

The third health quality measure analyzed is supposed to be an indicator of the hospital quality when patients with AMI are treated with PTCA. The precise definition of the measure is the ratio of the 30-day Crude Mortality Rate of patients treated with PTCA over the general Crude Mortality Rate (i.e. the first Health Quality Measure in Table 5). As one can see in the third column of Table 5, as well as from the third map of Figure 1, Abruzzo and Molise are the regions with a higher 30-day mortality for patients treated with PTCA, while the best performance on this indicator is obtained by Lazio and Emilia Romagna (NOTA: MAPPA DA RIFARE). Unlike the other two measures, excluding Abruzzo and Molise, the results obtained among the other regions do not show significant differences. The homogeneity of incidence of mortality in patients treated with PTCA indicates a general widespread appropriateness of the administration of this practice to cases that require it.

Table 5: Regional Fixed Effects Results V3:Esclusione regioni a statuto speciale

Region	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
Abruzzo & Molise	11.994***	22.777***	2.640***
	(.480)	(.727)	(.0386)
Campania	9.749***	21.974***	1.477***
	(0.344)	(0.545)	(0.044)
Emilia Romagna	6.873***	21.250***	1.464***
	(0.332)	(0.564)	(0.055)
Lazio	9.216***	18.699***	1.366***
	(0.408)	(0.690)	(0.051)
Liguria	9.302***	21.404***	1.453***
	(0.392)	(0.633)	(0.056)
Lombardia	8.033***	22.847***	1.403***
	(0.264)	(0.480)	(0.040)
Marche	7.492***	21.839***	1.529***
	(0.652)	(0.825)	(0.059)
Piemonte	8.474***	19.949***	1.568***
	(0.332)	(0.558)	(0.047)
Puglia	10.123***	21.273***	1.548***
	(0.532)	(0.455)	(0.040)
Toscana	6.160***	20.265***	1.599***
	(0.290)	(0.461)	(0.046)
Umbria	9.021***	20.723***	1.722***
	(1.589)	(0.725)	(0.079)
Veneto	8.947***	22.078***	1.542***
	(0.246)	(0.408)	(0.044)
volumi	0.004***	0.006***	0.001***
	(0.001)	(0.001)	(0.000)
Popover55	-0.000	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Observations	2,447	2,447	1,756
R-squared	0.802	0.918	0.934

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

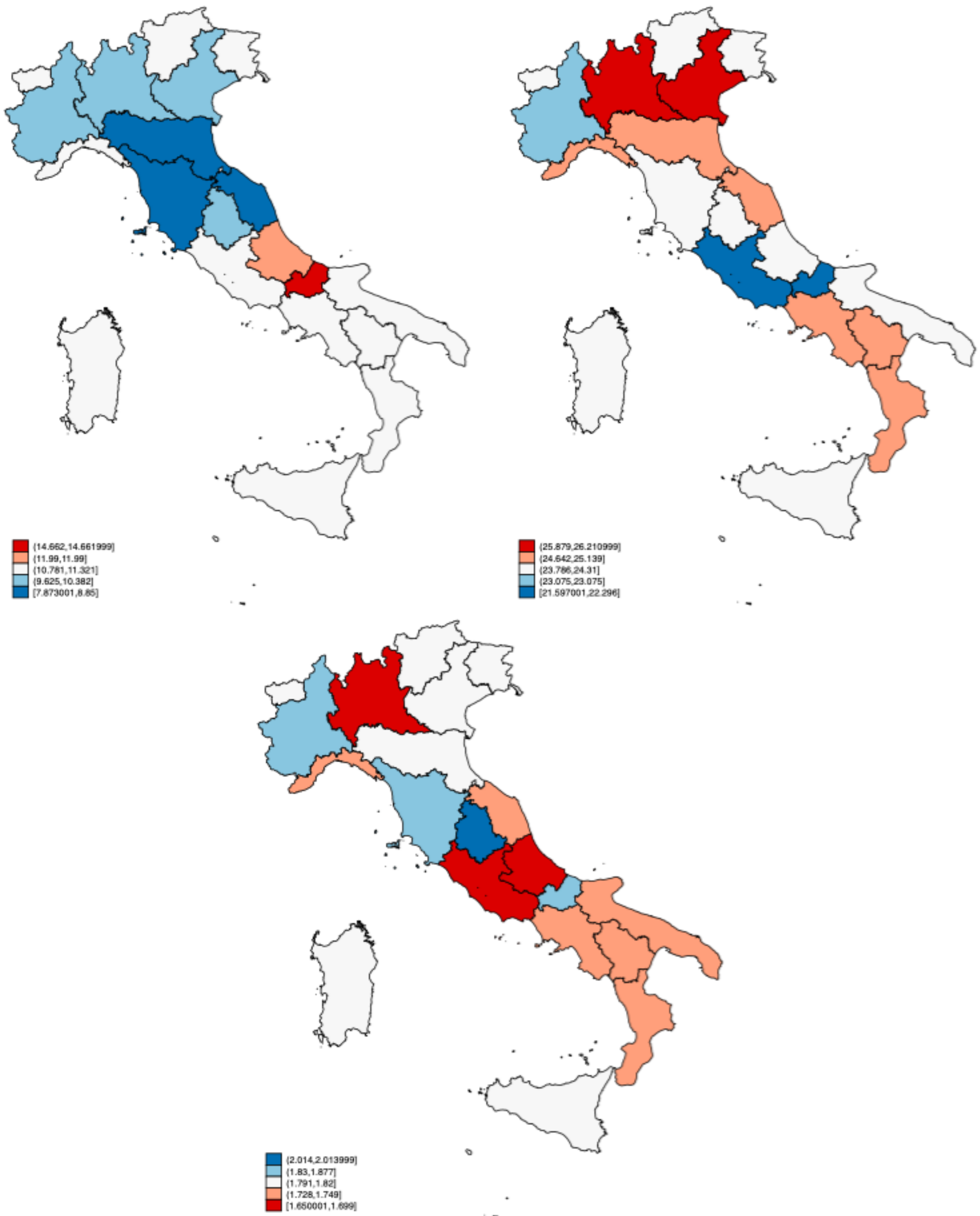

Figure 1: Regional distribution of 30-day mortality rate, 365-day readmission rate and Ratio of 30-day CRM for treated w/PTCA versus not treated

5.1.2 Macro Area fixed effects

We replicate the first step of the analysis for macro areas in order to get a broader perspective of geographical differences in the healthcare systems. Results of the macro area fixed effects are reported in Table 6. The results for the three health quality measures (30-day mortality rate, 365-day readmission rate and the ratio of 30-day crude mortality rate for treated with PTCA versus not treated) are respectively in the first, second and third column of the Table.

Starting looking at the 30-day crude mortality rate, as one can see there is a significative difference between North and South, with the South area showing a CMR 17% higher than the North. This confirms the expectations we had from the results obtained in the regional analysis.

The results for the second HQM are controversial (see 5.1.1): the North shows a higher readmission rate at 365 days with respect to both Sud and Centro. However a couple of observations need to be done about this finding. First, the combination of a high readmission rate with a low mortality rate can be a signal of good healthcare quality: people die less but as a consequence the readmission rate in the long run increases. Secondly, we need to take into account the inter-regional mobility in the case of readmissions due to non-emergency complications. This mobility will be driven by the desire to seek treatment in hospitals with better quality, whose regions will therefore register a higher readmission rate.

The third HQM analyzed is the ratio of 30-day crude mortality rate for treated with PTCA versus not treated. From Table 6 is possible to notice that North Area and South Area show the same performance, whereas Centro Area has a higher mortality rate of patients treated with PTCA over not treated patients, even if the difference is not consistent. A consistent and significant higher value would have suggested inappropriateness in the administration of PTCA treatment and it would have been useful to investigate further to understand the reasons. The geographical distribution per area of each of the three HQMs analyzed is shown in Figure 2.

In both, the regional analysis and the analysis per macro area, we included control variables for district and hospital characteristics: the population over 55 years, which is exposed to a higher risk for AMI and cardiovascular diseases, and the volumes in the hospital.

Table 6: Macro Area Fixed Effects Results V3:Esclusione regioni a statuto speciale

Region	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
Nord	9.254***	24.064***	1.763***
	(.231)	(.383)	(.021)
Centro	9.024	22.236***	1.818*
	(.267)	(24.064)	(.021)
Sud	10.838***	23.477*	1.737
	(.228)	(.305)	(.022)
Volumes	.0001532	-.0006758	.0002952***
	(.0005304)	(.0005744)	(.0000443)
Pop over 55	2.63e-07	5.51e-07	-6.12e-08**
	(2.28e-07)	(2.87e-07)	(2.27e-08)

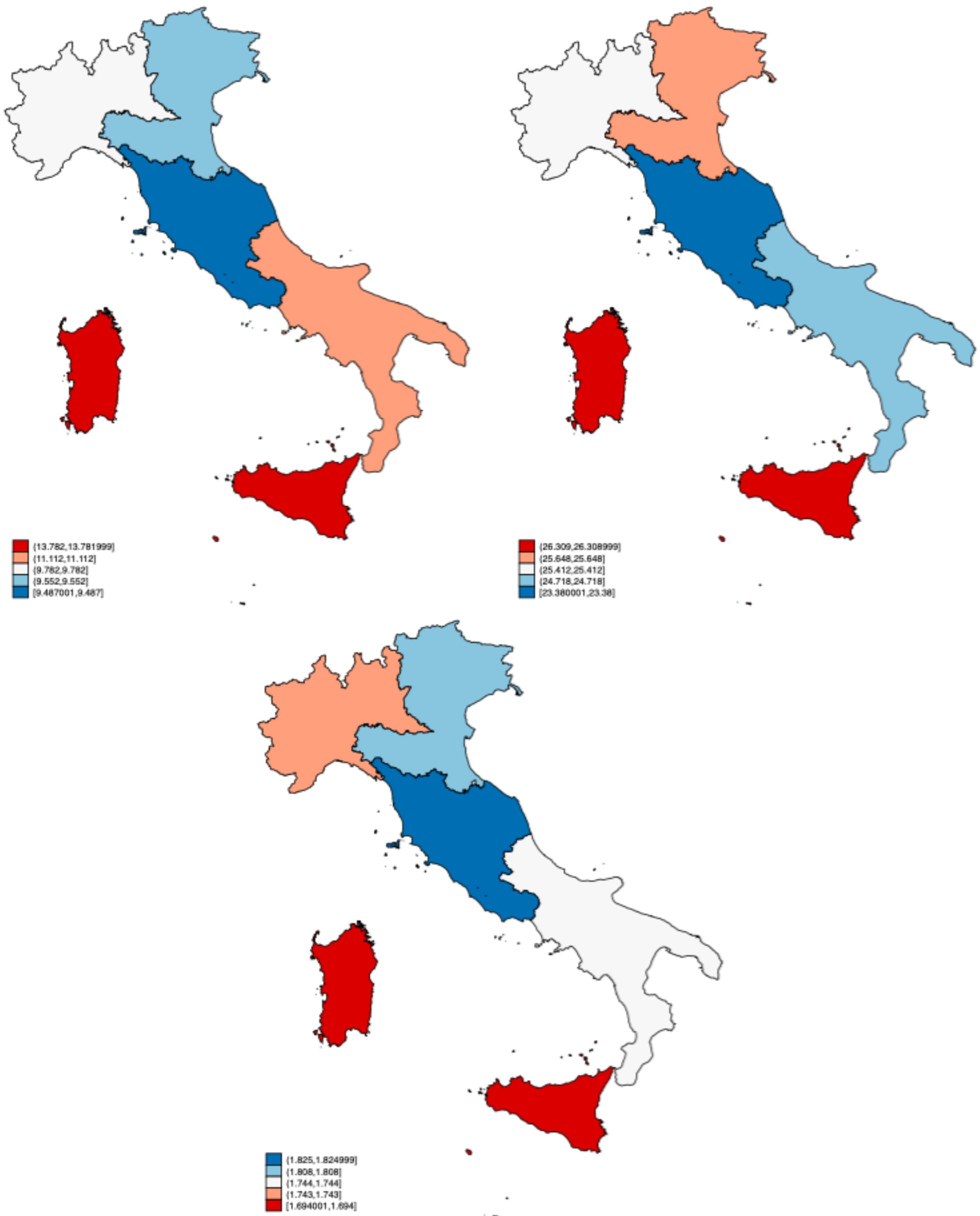

Figure 2: Regional distribution of 30-day mortality rate, 365-day readmission rate and Ratio of 30-day CRM for treated w/PTCA versus not treated

5.2 Results of the second step

In the second step of the methodology, we use the time-varying effects obtained in the first step and also the full available data at hospital level to implement the vector autoregressive analysis and thus assess persistence of healthcare quality and forecast future performance. The VAR parameters are estimated by using the information on all three Health Quality Measures.

; the regional level, considering for each region the fixed effect obtained in the first step and its temporal lags; the macro area level, considering for each macro area the fixed effect obtained in the first step and its temporal lags.

5.2.1 Vector Autoregression Model: hospital level

The VAR analysis at individual level has been conducted by using the data at hospital level available in the Piano Nazionale Esiti dataset. Among the nine waves, we tested the optimal number of lags to include obtaining two. The specification is the one in Equation 4.2, although other specifications, with different lag lengths and with the exclusion of one of the three HQMs, were tested. The hospital smoothed parameter estimates are reported in Tables 7 and indicate the effect that past values of each of the three outcome measures have on their own performance. The results suggest that the two HQMs "30-day mortality rate" and "365-day readmission rate" are quite persistent, thus seeing in particular the first lag of both having a significative impact on the same measure one year later. The coefficient of the first lag of the "30-day mortality rate" on determining the "30-day mortality rate" in year t is 0.361, whereas the coefficient of the first lag of the "365-day readmission rate" on determining the "365-day readmission rate" in year t is 0.655. While the results suggest that the third HQM - "Ratio of 30-day CRM for treated w/PTCA versus not treated " - is not persistent. The inclusion of the third lag yielded similar scores for all the three HQMs. The exclusion of the "Ratio of 30-day CRM for treated w/PTCA versus not treated " in the Vector Autoregression of the "30-day mortality rate" strengthens the impact of the first lag of the same measure as well as the impact of the first two lags of the "365-day readmission rate". The same happens if we exclude the same HQM in the VAR of the "365-day readmission rate". (Chiedere a Marina se inserire anche quella tabella o no). Robustness check: run separata per ospedali di piccole e grandi dimensioni.

Table 7: Estimates of multivariate VAR(2) parameters at hospital level

Region	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
30-day mortality rate per 100 (σ) (t-1)	.361***	.141*	-.019***
	(.072)	(.085)	(.007)
30-day mortality rate per 100 (σ) (t-2)	.137**	.049	-.008*
	(.052)	(.041)	(.004)
365-day readmission rate per 100 (σ) (t-1)	.240***	.655***	-.012
	(.051)	(.064)	(.005)
365-day readmission rate per 100 (σ) (t-2)	.175***	.241***	-.009*
	(.035)	(.047)	(.003)
Ratio of 30-day CRM for treated w/PTCA versus not treated (σ) (t-1)	2.682*	1.542	-.056
	(1.259)	(1.441)	(.154)
Ratio of 30-day CRM for treated w/PTCA versus not treated (σ) (t-2)	1.505*	1.077	-.089
	(.876)	(1.076)	(.107)

5.2.2 Vector Autoregression Model: regional level

To check the robustness of the persistence signal obtained in the Vector Autoregressive model applied to hospital data, we ran the he same VAR model specification at regional level. The VAR analysis at regional level has been conducted by using the results obtained in the first step of the analysis (i.e. regional fixed effects).

We chose to use a lag-length of 2 periods to obtain results comparable to those obtained in Section 5.2.1. Although as before other specifications, with different lag lengths and with the exclusion of one of the three HQMs, were tested. The regional smoothed parameter estimates are reported in Tables 8 and indicate the effect that past values of each of the three outcome measures have on their own performance. Looking at the regional level, the "30-day mortality rate" is slightly more persistent than at the hospital level: the value of the coefficient of the first lag is 0.462 in Table 8 and 0.361 in Table 7. The first lag of the "30-day mortality rate" is the only one which gives a significant contribution to the current value of the "30-day mortality rate". If we look at the readmission rate - second column of Table 8 - we see two significative coefficients: the second lag of the "30-day mortality rate" and the second lag of the "365-day readmission rate". However only the former has a considerable positive effect on the outcome (0.390). No significative persistence is observed for the third HQM ("Ratio of 30-day CRM for treated w/PTCA versus not treated "). Overall one can see that only the "30-day mortality rate" (in its first or second lag) can be used to predict the future values of the three HQMs.

Table 8: Estimates of multivariate VAR(2) parameters for regional-specific effects V3

Region	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
30-day mortality rate per 100 (σ) (t-1)	0.462***	-0.350	-0.021***
	(.197)	(.226)	(.016)
30-day mortality rate per 100 (σ) (t-2)	0.090	0.390***	-0.011
	(.121)	(.087)	(.011)
365-day readmission rate per 100 (σ) (t-1)	-0.305	-0.012	0.000
	(.215)	(.241)	(.016)
365-day readmission rate per 100 (σ) (t-2)	0.060*	-0.036***	0.017
	(.184)	(.216)	(.017)
Ratio of 30-day CRM for treated w/PTCA versus not treated (σ) (t-1)	-1.881	-1.676*	-0.462
	(3.674)	(3.809)	(.356)
Ratio of 30-day CRM for treated w/PTCA versus not treated (σ) (t-2)	-5.401*	-.807	-.127*
	(3.085)	(3.275)	(.239)

6 Conclusions

The Italian national health system is public, with universal coverage and financed with financial resources from general taxation. The system is jointly regulated by the state, which is responsible for defining the package of benefits and mandatory resources, and by the regions that organize health services in their area of ??responsibility, which are managed by healthcare companies. In the 1990s, to address the issue of financial risk competences, the State decided to transfer part of the tax leverage to the regions, thus aligning the autonomy of expenditure with that of financing.
Because of this marked regional autonomy in the management of health services, it is important to analyze the performance of Italian regions using shared reference indicators. This is possible thanks to the availability of the data collected by the Ministry of Health which converge in the annual publication of the national results plan (Piano Nazionale Esiti, PNE). In this study we used a two-step methodology, based on the work of McClellan and Staiger (1999), first to extract a quality signal from regional health systems and secondly to obtain information on the persistence of this quality signal.

In their study, Papanicolas and McGuire (2016), following the approach of McClellan and Staiger (1999), used English, patient level data - for individuals suffering from heart disease (AMI) or who have undergone a HIP replacement surgery - to create quality indicators at the hospital level. They suggested that their method could tackle some of the main limitations that are inherent in hospital quality measurement, allowing them to create indicators which reduce noise both within individual hospitals and across time, as well as integrate different dimensions of quality within a single estimator. This paper has applied their method to Italian region level data related to

AMI to extract quality indicators at regional level. We have been able to exploit the availability of risk-adjusted measures of quality for 283 Italian hospitals. Our results suggest that this method might be also applied at a more aggregate level. In order to check the robustness of this result we did apply this method also to extract a signal of quality of healthcare for four Italian macro areas: North-East, North-West, Center and South. Our application of this method to a different level did identify other issues, for example the smaller sample size that is available if one considers data at hospital level rather than patient level. To outline the approach in the first step we use the hospital level data to extract a regional fixed effect and a macro area fixed effect. In the second step of the methodology we relied on a VAR(2) specification to investigate the degree of persistence of hospital quality at hospital level and regional level.

Overall the estimates obtained through the two-step analysis based on three quality measures for an emergency condition, like the Acute Myocardial Infarction (AMI), seem to reasonably reflect differences in the underlying hospital quality across Italian Regions. Furthermore, a multidimensional interpretation of the signal of persistence obtained in the second step of the analysis can help in predicting patients' mobility across Regions and can address policy interventions to be implemented at national level to rebalance this gap.

Obviously, the results would be much more robust if the number of quality measures available could also be extended to indicators of efficiency and process of the hospital and not using only indicators of outcome. Another important extension would be to compare regional differences for emergencies and elective diseases. On the latter, in fact, patients have a greater chance of finding better quality hospitals and being treated in these. Including these in the analysis would make it possible to obtain more reliable estimates for predicting interregional mobility.

7 Appendix

Table 9: Regional Characteristics V1:All obs

Region	*Number of hospitals*	*Number of districts*	*Mean cases per year*
Abruzzo	8	4	2,640
Campania	36	5	9,209
Emilia Romagna	25	9	10,365
Friuli Venezia Giulia	1	1	119
Lazio	28	5	8,671
Liguria	9	4	3.138
Lombardia	50	12	15,248
Marche	2	1	640
Molise	1	1	146
Piemonte	24	8	7.626
Prov. Auton. Bolzano	2	1	681
Prov. Auton. Trento	2	1	852
Puglia	26	6	5,628
Sicilia	1	1	79
Toscana	22	10	7,952
Umbria	7	2	1.946
Val D'Aosta	1	1	290
Veneto	38	7	7,181
Total	283	79	82,421

Table 10: Macro Area Characteristics V1:All obs

Macro Area	*Number of hospitals*	*Number of districts*	*Number of regions*	*Mean cases per year*
Nord	152	44	8	45,500
Centro	59	18	4	19,209
Sud	72	17	8	17,712
Total	283	79	20	82,421

Table 11: Regional Fixed Effects Results V1: All obs

Region	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
Campania	-1.009	.940	0.072
	(.534)	(.998)	(.046)
Emilia Romagna	-3.225***	.809	0.161**
	(.505)	(.941)	(.047)
Friuli Venezia Giulia	-.743	6.081**	-0.238***
	(1.415)	(2.270)	(.050)
Lazio	-.827	-1.836	0.035
	(0.554)	(1.041)	(.047)
Liguria	-1.178*	.539	0.085
	(.572)	(1.009)	(.050)
Lombardia	-2.311***	1.967*	0.015
	(.486)	(.928)	(0.41)
Marche	-3.141***	.344	0.099
	(.788)	(1.282)	(.061)
Molise	2.672	-2.719	0.181
	(1.400)	(1.874)	(.107)
Piemonte	-1.966***	-1.204	0.190***
	(.514)	(.965)	(.047)
Prov. Auton. Trento	-3.470***	.731	0.007
	(.760)	(1.212)	(.081)
Puglia	-.649	-.300	0.089
	(.658)	(.985)	(.050)
Sicilia	1.990	1.949	0.028
	(1.637)	(2.615)	(.038)
Toscana	-4.129***	-.496	0.223***
	(.488)	(.933)	(.045)
Umbria	-1.726	-.516	0.363***
	(1.569)	(1.120)	(.090)
Val D'Aosta	-2.995**	-1.229	0.519**
	(1.027)	(1.319)	(.196)
Veneto	-1.579**	1.599	0.138**
	(.519)	(.964)	(.045)
Volumi	-.0000374	-0.00225**	0.000255***
	(.0005537)	(.0007127)	(.0000458)
Popolazione over 55	-0.000000659**	0.00000042	1.45e-08
	(2.49e-07)	(4.72e-07)	(2.73e-08)
Constant	11.995***	24.33***	1.652***

Table 12: Macro Area Fixed Effects Results V1bis (con pop over 55)

Region	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
Nord-Est	-.155	.133	.057**
	(.196)	(.374)	(.025)
Centro	-.295	-2.000***	.074***
	(.272)	(.347)	(.023)
Sud	1.354***	-.653*	-.007
	(.238)	(.388)	(.023)
Isole	4.100**	.886	-.053***
	(1.574)	(2.467)	(.018)
Volumi	-.0005978	-.0025554 ***	.000275***
	(.0005904)	(.0006956)	(.0000448)
Popolazione over 55	1.56e-07	2.53e-07	-5.52e-08 **
	(2.38e-07)	(3.45e-07)	(2.30e-08)
Constant	9.760***	25.458***	1.748418 ***

Table 13: Estimates of multivariate VAR(2) parameters for regional-specific effects V1

Region	*30-day mortality rate per 100 (σ)*	*365-day readmission rate per 100 (σ)*	*Ratio of 30-day CRM for treated w/PTCA versus not treated (σ)*
30-day mortality rate per 100 (σ) (t-1)	0.884***	3.649***	-0.027***
	(.083)	(.408)	(.007)
30-day mortality rate per 100 (σ) (t-2)	0.317***	2.110***	-0.004
	(.057)	(.356)	(.006)
365-day readmission rate per 100 (σ) (t-1)	-0.056***	-0.462***	0.000
	(.009)	(.052)	(.000)
365-day readmission rate per 100 (σ) (t-2)	0.018*	-0.431***	0.002***
	(.008)	(.044)	(.000)
Ratio of 30-day CRM for treated w/PTCA versus not treated (σ) (t-1)	-1.053	5.020*	-0.153
	(.956)	(5.588)	(.136)
Ratio of 30-day CRM for treated w/PTCA versus not treated (σ) (t-2)	-1.236*	-14.378***	-.126*
	(.520)	(2.555)	(.053)

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