Social Science & Medicine 190 (2017) 38–47

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

The political economy of diagnosis-related groups☆

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ARTICLE INFO

Article history:
Received 2 November 2016
Received in revised form
26 July 2017
Accepted 7 August 2017
Available online 12 August 2017

Keywords:
Italy
DRG
Health care spending
Politicians
Regional governments
Budget cuts
Health care deficits

ABSTRACT

A well-established political economic literature has shown as multi-level governance affects the inefficiency of public expenditures. Yet, this expectation has not been empirically tested on health expenditures. We provide a political economy interpretation of the variation in the prices of 6 obstetric DRGs using Italy as a case study. Italy offers a unique institutional setting since its 21 regional governments can decide whether to adopt the national DRG system or to adjust/waive it. We investigate whether the composition and characteristics of regional governments do matter for the average DRG level and, if so, why. To address both questions, we first use a panel fixed effects model exploiting the results of 66 elections between 2000 and 2013 (*i.e.*, 294 obs) to estimate the link between DRGs and the composition and characteristics of regional governments. Second, we investigate these results exploiting the implementation of a budget constraint policy through a difference-in-differences framework. The incidence of physicians in the regional government explains the variation of DRGs with low technological intensity, such as normal newborn, but not of those with high technological intensity, as severely premature newborn. We also observe a decrease in the average levels of DRGs after the budget constraint implementation, but the magnitude of this decrease depends primarily on the presence of physicians among politicians and the political alignment between the regional and the national government. To understand which kind of role the relevance of the political components plays (*i.e.*, waste vs. better defined DRGs), we check whether any of the considered political economy variables have a positive impact on the quality of regional obstetric systems finding no effect. These results are a first evidence that a system of standardized prices, such as the DRGs, is not immune to political pressures.

1. Introduction

Health care expenditures is a major component of GDP and a competence of local governments in decentralized or federal settings. A remarkable political economic literature explores how multiple layers of government affect the level of taxation, the performance and quality of the public sector, and the level of a country's deficit. However, little attention has been paid to how politicians and their incentives affect the health care sector. Political interests play a crucial role in the health care arena, as shown in recent work by Bloom et al. (2015, 2015) use the margin of victory in U.K. districts as an instrument for hospital competition at the local level. The instrument captures the fact that the lower the incumbent party's margin of victory, the less likely a hospital in that district is to close, as politicians do not wish to upset their constituents. This paper contributes to the literature inaugurated by Bloom et al. (2015) by empirically testing, for the first time with respect to health care, the commonly accepted prediction that multi-level governance affect the inefficiency of public expenditures. Our evidence is based on the relationships between characteristics of political institutions and the average levels of diagnosis-related groups (DRGs), particularly of obstetric DRGs.

Based on the cost function of a representative sample of hospitals, DRGs are a common mechanism for paying hospitals and measuring hospital activity within a country with the goal of reducing waste in health care (Kimberly and De Pouvourville, 2008; Paris et al., 2010). However, the decision of whether and when to

☆ We would like to thank Vincenzo Atella, Tommaso Nannicini, Oleg Sidorkin, Jan Zapal, the participants to the Czech Economic Society conference, and two anonymous referees for their comments, and Igor Cerasa for his excellent work as our research assistant. Support from Grant IG505077 is gratefully acknowledged.

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http://dx.doi.org/10.1016/j.socscimed.2017.08.006
0277-9536/

adopt DRGs is often left to local governments or insurers (Busse et al., 2011). In the 1980s, the US became the first country to introduce DRGs for its federal programs, Medicare and Medicaid. At present, new forms of DRG tariffs, such as the All Patients Refined DRGs (APR-DRGs), are employed at the state level to pay for both publicly funded programs and patients covered by commercial insurers. The implementation of the APR-DRGs varies, and each state makes adjustments to better match the characteristics of its population and case mix. Sweden also has a national DRG system, but counties, which are the local authorities responsible for the health care sector, can waive the national system to account for local needs. In Spain, the provinces have some discretion regarding the timing of DRG adoption. In Germany, the development of DRGs is driven by provider associations and sickness funds. In Italy—which is our testing ground— regions can either conform to the national DRGs or set their own.

To examine how the characteristics of local governments affect the average level of each DRG, we assume that each observed DRG is the sum of two components, a "true" DRG tariff and a non-market markup. The true DRG tariff is a function of at least two sets of variables: resident population characteristics and structural supply indicators such as the number of employees, the number of beds, and technological investments, which could affect the cost of providing a treatment. The non-market markup exists because it can be difficult to observe the true DRG value and this leaves ground for strategic manipulation of the tariffs: by definition, this markup must be positive. Improving the accuracy of the true DRG value implies an improvement in the efficiency of the health care system. Conversely, manipulating the markup and exploiting the lack of transparency in the system increase the inefficiency of the health care system. It is not possible to directly test the effect of the political characteristics on each component, but we provide an indirect test.

Our empirical strategy relies on Italian data. Italy provides a heterogeneous institutional setting to demonstrate the role of local governments in determining the level of DRGs, as it counts 21 regional health care systems and local government elections are staggered. We collected the DRG tariffs adopted by Italian regions from 2000 to 2013 for 6 obstetric DRGs: cesarean and vaginal delivery with and without complications, as well as severely premature and normal newborns. The differences in these DRG prices across regions can be substantial. For instance, in 2000, the payment for a vaginal delivery with no complications in Tuscany was almost 30% higher than that in the nearby Emilia Romagna and nearly 40% lower than that in the nearby Umbria despite the fact that Umbria, Tuscany, and Emilia Romagna have similar socioeconomic and population health characteristics.

To investigate the potential role of local government characteristics, we follow two strategies. First, using panel data at the region-year level, we test whether 5 regional government variables are relevant to our DRG outcomes. These variables are the percentage of politicians being doctors, the percentage of politicians with college degrees, the percentage of regional government officials not appointed through elections, a dummy variable indicating political alignment between the regional and national governments (*i.e.*, same political coalition), and the number of parties represented in the regional council. Second, we exploit a policy introduced in Italy in 2006 that forces regions with health care deficits to participate in a repayment plan. The goal of the repayment plan is to reduce the deficit through a general re-organization of the health care system. Since only some regions had to participate in this plan, we can implement a difference-in-differences approach including interactions for all the government characteristics considered to whether the latter affect regional governments' response to the repayment plan with respect to DRG tariffs.

Under both strategies, any detected effect of politics on DRGs could reflect either a distortion or improved definition (*i.e.*, an efficiency gain) of the observed DRG price. In order to disentangle negative influences of government characteristics from beneficial ones, we exploit a unique dataset based on patient discharge records to generate proxies for obstetric quality. Then, we replicate both previously described empirical strategies using these proxies to determine whether any local government characteristics affect the quality of the obstetric system.

This paper is organized as follows. Section 2 presents the institutional background on the DRG system in Italy, its main developments in our period of interest, and background information on the repayment plan policy. Section 3 details the data used in the empirical analysis in Section 4. Section 5 presents the main results, and Section 6 concludes.

2. Institutional background

Italy counts 19 regions and 2 autonomous provinces (the Autonomous Province of Trento and the Autonomous Province of Bolzen), which are responsible for providing medical assistance to their residents. Local governments must comply with national standards (Lisac et al., 2008), but they can freely choose how to regulate and structure health care delivery within their territory. As a result, the country includes 21 micro-health care systems that rely on different mixes of local health authorities (LHAs), independent hospitals (*e.g.*, teaching hospitals) and private institutions (Anessi-Pessina et al., 2004). Patients are covered by health plans provided by LHAs according to their place of residence, but there is intra- and inter-regional mobility.

The Italian government released the first DRG tariff list with Legislative Decree 169/1994; the list was based on the DRGs classification developed in the US. As a result, since January 1995, all hospitals have been funded through a DRG-based system, which is enforced for every inpatient (Cavalieri et al., 2013). National tariffs were calculated based on data gathered from eight hospitals located in the Northern and Central regions without differentiating among hospital types (Fattore and Torbica, 2006). Hence, teaching hospitals were assumed to have the same production function as non-teaching hospitals.

National tariffs are only benchmarks, and regional governments can both set their own rates and adjust them by hospital type. The majority of regions have developed their own tariffs using cost assessments based on representative samples of their own hospitals, and only a few (6 in 2000 and 2013) conform to the national tariffs (Assobiomedica (2002)). At the regional and national levels, DRG tariffs are based on the cost function of a sample of hospitals. Thus, an individual hospital is not able to request for a review of these prices based on its own budgets. Still, the setting of national and regional DRG tariffs is regulated by a Ministry of Health decree dated April 15, 1994. According to this decree, the tariffs are calculated by taking into account the cost of the personnel directly employed, the cost of materials and equipment used, and the general costs of the responsible ward. The latter costs refer to expenses that are not directly due to a specific treatment/procedure and are shared equally across the treatments provided by the ward. To ensure comparability and homogeneity in hospital cost accounting, the financial statements of health care providers must comply with the rules and the standardized layout established by the Inter-ministerial Decree of October 20, 1994, which was updated by Decree 118/2011.

Despite the common assessment and financial reporting rules, the differences between national and regional rates can be substantial. Fig. 1 plots the ratios of regional to national tariffs for two DRGs in 2000 and 2013: vaginal deliveries without complications

and normal newborns. Vaginal deliveries without complications are paid from −20% to +56% of the national rate, and this range is from −26% to +20% for normal newborns. These huge variations cannot be explained differences in technologies, since these DRGs should not be substantially affected by progress in medical science. Although there might be territorial differences in the costs of providing a procedure for which we can control, the costs of important inputs, such as personnel, do not vary sufficient across to explain these differences. In Italy, physicians and nurses are civil servants and are paid according to a collective labor agreement (*Contratto collettivo nazionale - CCNL*) such as the CCNL 2002–2005 and the CCNL 2006–2009.

2.1. Repayment plan policy

The 2006 National Budget Law (Law 266/2005) introduced a new tool for the central government to monitor and punish regions with health-care related deficits: repayment plans (*i.e.*, *Piani di rientro*). These plans are contractual agreements between the national and regional governments and are imposed whenever the regional health care deficit is greater than or equal to 7% of the deficit in the previous year (Ministero della Salute, 2006b).

Under a repayment plan, the region must provide the central government with a credible plan for re-organizing its health care system. Overall, the goal is to promote efficiency in the regional health care system while preserving the minimum level of assistance established by national standards. The region provides a list of measures documented in the plan. Table A1 summarizes the main policy measures and related goals typically included in a repayment plan. For example, one common measure is to reduce the number of hospital beds. The aims of this change are to induce patients to rely on (less expensive) outpatient clinics and to encourage hospitals to directly distribute drugs to patients with chronic conditions. In addition, the region has to increase its

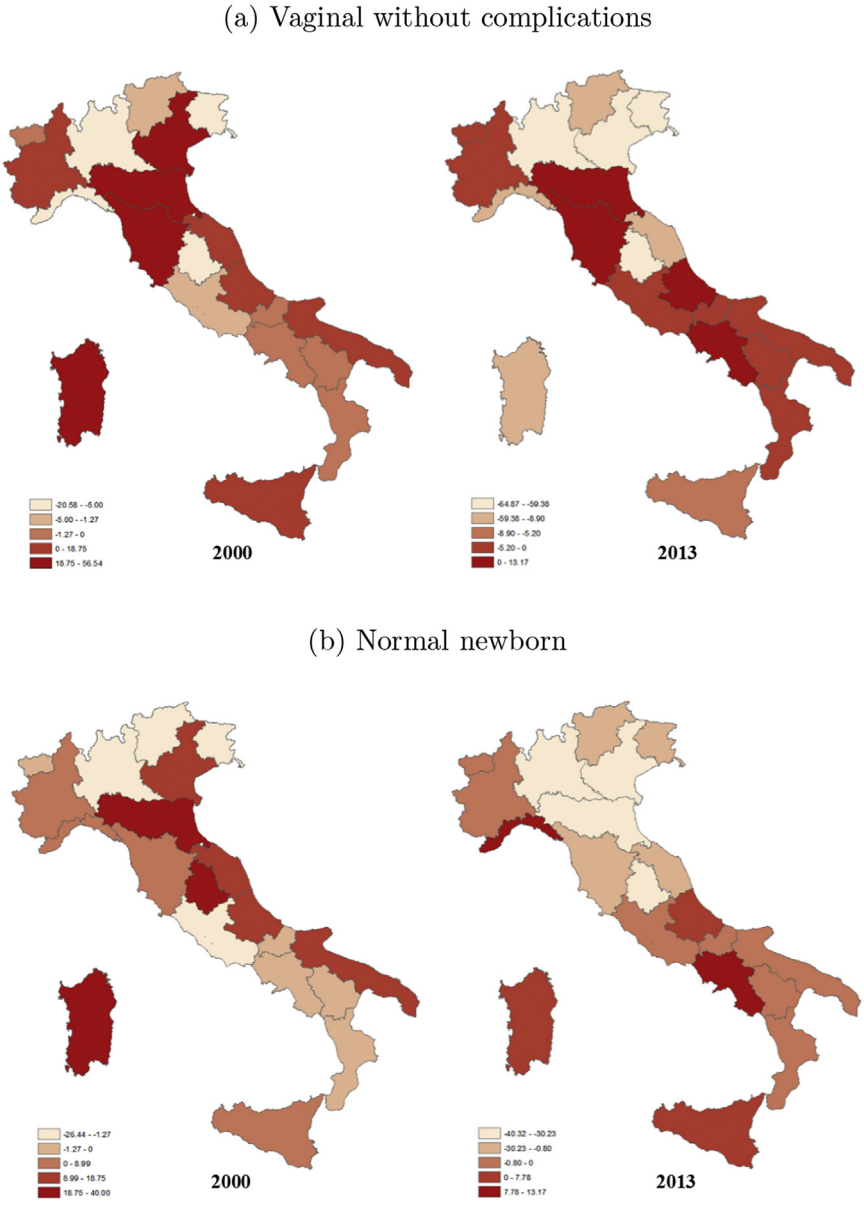

Fig. 1. Differential Rate Between Regional and National DRGs.
Notes: These figures depict the differential rate between regional and national tariffs. The darker the areas are, the higher the differential rate.

regional tax rates (*i.e.*, the income surcharge and the regional tax on production). In exchange, the central government provides access to supplementary budget funds to improve its financial position and to ensure that health assistance can be provided to its citizens. Regional governments should naturally dislike being placed on a repayment plan, as it limits their fiscal policy discretion and thus jeopardizes reelection.

The first repayment plans were created in 2007 and represent the principal mechanism of constraining the budgets of problematic regions. For instance, according to Farmafactoring (2012), repayment plans are successful instruments of cost containment. During the period 2007–2010, the average annual growth rate of health care expenditures was 2.4%, whereas this rate was 6.6% for the period 2001–2006. Over time, the central government has imposed repayment plans on ten regions: Abruzzo, Campania, Lazio, Liguria, Molise, Sardinia and Sicily in 2007, Calabria in 2009, and Piedmont and Puglia in 2010 (Fig. A1).

3. Data and material

DRG. Data on DRGs per region and year over the period 2000–2013 were collected through the analysis of regional legislations. We consider 6 DRGs strictly related to a delivery. Four DRGs refer to the mother: cesarean deliveries with and without complications and vaginal deliveries with and without complications. The remaining two DRGs are related to the newborn: severe prematurity (*i.e.*, pre-term infant or one born with serious respiratory problems) and normal newborn.

Presently, there are 538 DRGs in the Italian system, but we focus on deliveries for four reasons. First, deliveries are associated with low levels of patient mobility. Between 2001 and 2013, on average, only 3% of mothers per year moved to another region to give birth (Ministero della Salute (2006a), Ministero della Salute (2012)). Table A2 provides details on the distribution of mothers from outside of the region. It is apparent that the patient inflows of each region receives are marginal. Similarly, the patient outflows are irrelevant, and no regions are clearly "export oriented" as shown in Table A3. This means that differences in prices should capture only differences in the cost of treating the local population and in the technological investment of the local system. Second, these 6 DRGs can be divided into those with high and low technological intensity. For instance, a vaginal delivery without complications is a procedure upon which recent dramatic developments in medical science should not have a strong impact (Cavallo et al., 2009). The same is true for the DRG paid for a normal newborn. However, the adoption of new technologies can substantially affect the cost of caring for severely premature newborns. For instance, incubators have significantly improved over time. Third, deliveries occur on an inpatient basis, and thus, there are no concerns regarding patient selection bias among patients treated inside and outside hospitals. In 2013, only 0.1% of mothers gave birth outside the health care system (Ministero della Salute (2014)). Moreover, these 6 DRGs cover the majority of cases for both the mothers (85% of all deliveries) and the newborns (80% of all newborns). This means that we consider the obstetric procedures that are most likely to occur in a hospital regardless of the type of hospital.

A maximum of 11 out of 21 regions adjust their DRG tariffs based on hospital type. To address the simultaneous application of different tariffs for a given DRG, region and year, we use the average price per DRG-region-year (see Table A4 for an example of our dataset). On average, Italian regions pay their hospitals 1897 euros (2015) for a natural delivery without complications, but 3075 euros would be paid for the same delivery by c-section. When complications arise, these average rates increase to 2813 and 4379 euros, respectively. For a seriously premature infant, the average payment to the hospital is 16,101 euros, while the payment is 609 euros for a normal newborn. Table A5 presents the descriptive statistics of our sample.

Quality Indexes. Higher health care expenditures do not necessarily imply waste and inefficiencies. A recent body of literature has shown that higher levels of expenditures indicate better delivered care (*e.g.*, Doyle et al., 2015 and Doyle (2011)). Hence, it is important to test the relation between government characteristics and the quality of obstetric care. Higher tariffs for a given procedure may simply capture the higher average quality of a regional system.

We use a unique dataset of 6,500,000 deliveries recorded through patient discharge cards (*Schede di Dimissione Ospedaliera*) from the Ministry of Health to construct a set of quality measures. These data are only available from 2001 onward and are reported separately for mothers and newborns. First, we create the inpatient quality indicators for obstetric practices suggested by the Agency for Health Research and Quality (AHRQ). These are i) the primary cesarean delivery rate, uncomplicated; ii) the cesarean delivery rate, uncomplicated; iii) vaginal birth after cesarean delivery; and iv) vaginal birth after cesarean delivery, uncomplicated. The focus is on procedures for which questions of overuse, underuse, and misuse exist or for which there is some evidence that a higher volume is associated with better quality. In this case, a delivery is considered uncomplicated if it is not associated with any of the following complications: abnormal presentation, preterm delivery, fetal death, multiple gestation diagnoses, and breech.

Second, to avoid relying solely on this narrow definition of complications, we construct 5 additional proxies for obstetric quality capturing all major complications suffered by mothers or newborns before, during and after delivery. For newborns, we generate the incidences of resuscitation attempts and vaginal and cesarean complications. For mothers, we calculate the incidence of complications due to vaginal and cesarean deliveries. In essence, we consider the number of complications, as coded in the discharge cards, and we calculate their incidence out of the total number of deliveries for mothers and out of the total number of babies for newborns. The number of deliveries and the number of newborns can differ due to multiple pregnancies or stillbirths. The underlying assumption is that the higher the incidence of complications or resuscitation attempts or the lower the inpatient quality indicators, the lower the quality of obstetric care in the regional system. However, since the incidence of complications could be connected to the riskiness of the treated population, we also calculate the incidence of low-risk vaginal and cesarean deliveries. Low-risk mothers are those who did not suffer from any of the main risk factors complicating pregnancy and/or delivery (*e.g.*, multiple pregnancy, breech presentation). This allows us to control for very specific characteristics of the population of mothers when using the quality indexes for mothers as outcomes. Analogously, we derive the incidence of low-weight babies (*i.e.*, below 1500 g) among newborns to control for risk factors that may explain the incidence of resuscitation attempts and complications among newborns. Table A6 provides a description of the variables and their sources. If the risk factors in the underlying population are constant over time, the addition of a control for low-risk mothers or low-birth-weight newborns should not affect the final results, as these characteristics are absorbed by regional fixed effects.

Political Economy Variables. At the regional level, DRG tariffs need to be approved by the regional government before being implemented. The regional government is composed of a fixed number of members that depends on the census population of the region. These members, including the governor of the region, are elected by universal suffrage. However, within the regional

government, the governor is assisted by a cabinet whose members are chosen by the governor herself. These cabinet members can even include professionals who have not been elected. For instance, to administer regional economic policies, the governor can appoint an economist rather than select from among the pool of elected politicians. Elections occur every 5 years and generate variation in the political variables. As shown in Table A7, we count 10 regional election waves between 2000 and 2013, for a total of 66 ballots. Most elections took place in 2000, 2005, and 2010, but they are staggered in some regions, such as those with special statute.

We know whether regional government members work as medical doctors, but we can not recover their medical specialty. Therefore, from the regional election results, we extract five proxies for the characteristics of regional governments: the proportion of medical doctors (*Doctors*) in the regional government; the proportion of politicians with college degrees, excluding physicians, to measure their education level, which is often used as a proxy for quality (*Graduates*); and the proportion of politicians who are not elected (*Not elected*). In addition, *Aligned* is a dummy equal to one if the regional and national governments are ruled by the same party coalition, while *N parties* counts how many parties are represented in the regional government. During the observation period, on average, 7% of regional government members are doctors, 49% graduated college, and 6% are not elected. Approximately 45% of regional governments are aligned with the national government, and regional governments include an average of eleven parties. Moreover, regional governments are mainly composed by natives of the region as, on average, 90% of the members come from the same region where they are elected (Table A8).

Table 1
Panel fixed effects results.

Panel A: C-section				
	With complications		Without complications	
	(1)	(2)	(3)	(4)
Doctors	799.709	1250.607	948.295	1068.728
	(1076.603)	(962.871)	(783.267)	(763.851)
Graduates	−303.217	−286.560	−462.124*	−482.947*
	(314.146)	(318.948)	(258.842)	(254.115)
Non elected	−446.811	−489.906	79.699	69.769
	(897.524)	(809.827)	(680.593)	(648.402)
Aligned	11.711	−3.116	−12.631	−17.690
	(46.972)	(45.896)	(39.914)	(39.303)
N. Parties	18.608	23.021*	4.060	5.078
	(11.117)	(11.445)	(6.460)	(6.925)
R^2	0.837	0.843	0.807	0.809
Panel B: Vaginal delivery				
	With complications		Without complications	
Doctors	1616.290*	1647.746*	1552.737**	1480.083**
	(896.788)	(799.571)	(704.082)	(607.509)
Graduates	−329.997	−359.866	−355.212	−351.915*
	(227.127)	(214.761)	(207.369)	(189.614)
Non elected	26.822	−63.186	−273.539	−375.636
	(596.653)	(544.770)	(361.444)	(321.109)
Aligned	−2.225	−6.838	−6.529	−8.725
	(38.281)	(38.741)	(25.006)	(26.111)
N. Parties	1.720	0.819	−3.834	−5.230
	(7.509)	(8.091)	(5.343)	(5.830)
R^2	0.807	0.814	0.745	0.754
Panel C: Newborn				
	Pre-Term or Respiratory Failure Newborn		Normal Newborn	
Doctors	−11.576	4003.384	457.224*	497.564**
	(7024.834)	(7550.175)	(233.552)	(230.793)
Graduates	−1236.263	−650.825	−44.386	−27.733
	(2586.706)	(2319.206)	−337.130	−387.134
Non elected	831.887	1020.692	(66.825)	(64.767)
	(4792.487)	(4531.566)	(231.272)	(242.173)
Aligned	−240.212	−326.781	−3.418	−6.534
	(246.075)	(232.276)	(7.543)	(6.982)
N. Parties	−65.348	−26.072	2.430	2.746
	(85.190)	(99.823)	(2.300)	(2.334)
R^2	0.435	0.455	0.223	0.266
Observations	294	294	294	294

Notes: The results are from a panel fixed effects model region/year. All regressions include year fixed effects. Models (1) and (3) control for *Cov*1; models (2) and (4) for *Cov*1 and *Cov*2. Standard errors clustered at the regional level in parentheses. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

4. Empirical strategy

Although we do not present a formalized model to explain how the political economy variables that we defined affect the DRG tariffs, we provide an intuitive reference framework for their expected effects. The basic assumption is that politicians want to maximize the probability of re-election. As a consequence, they will try to please their constituencies. There are several means to achieve this goal. Politicians can implement useful policies and provide voters with needed services, they can redistribute wealth within their constituency to those who will have the strongest support for their re-election, and they can try to exploit the fact that they are operating in a multilevel government system. Multi-level governance can be exploited by lower levels of government to shift the blame for public sector inefficiencies onto higher levels (*e.g.*, Bordignon et al., 2015). At the same time, lower levels of government can take advantage of financial resources that are not directly provided by their local constituencies due to the redistribution that characterizes a system of transfers. For instance, if the local and national governments belong to the same party coalition, it is in the best interests of both to guarantee votes for the party. Hence, the national government could be more lenient in imposing fiscal restraints on governments of the same coalition than on those belonging to opposition parties (Bracco et al., 2015). Alternatively, the national government could be more generous and provide more transfers to local governments of the same political leanings (Arulampalam et al., 2009).

Consequently, we expect that the share of physicians can affect the DRG tariff in two ways. *Doctors* could directly influence the observable DRG tariff of procedure i in region r in year t, DRG_{irt} because physicians should be more aware of the true costs and thus better able to make price setting decisions for treatment i. However, a higher share of physicians could lead to greater resources (*i.e.*, higher rents) for the health care system. Therefore, *Doctors* could affect DRG_{irt} in order to please their constituencies and to redistribute more money to the production sector they represent, maximizing the probability of re-election. Conversely, higher shares of more educated and less politically career-oriented members should reduce the markup, and the observed DRG_{irt} should converge toward the true value. However, unelected members could still have re-election concerns, as their appointment could represent a first step in a political career. Hence, the ultimate effect of this component might not be straightforward *ex ante*.

Both *Aligned* and *N parties* are positively associated with public money availability and, potentially, with more waste. The number of parties represented in the regional council proxies for political fragmentation and potential common pool problems (*e.g.*, see Persson and Tabellini, 2000). According to the existing literature, aligned local governments can benefit from more intergovernmental transfers (Arulampalam et al., 2009). Moreover, they could

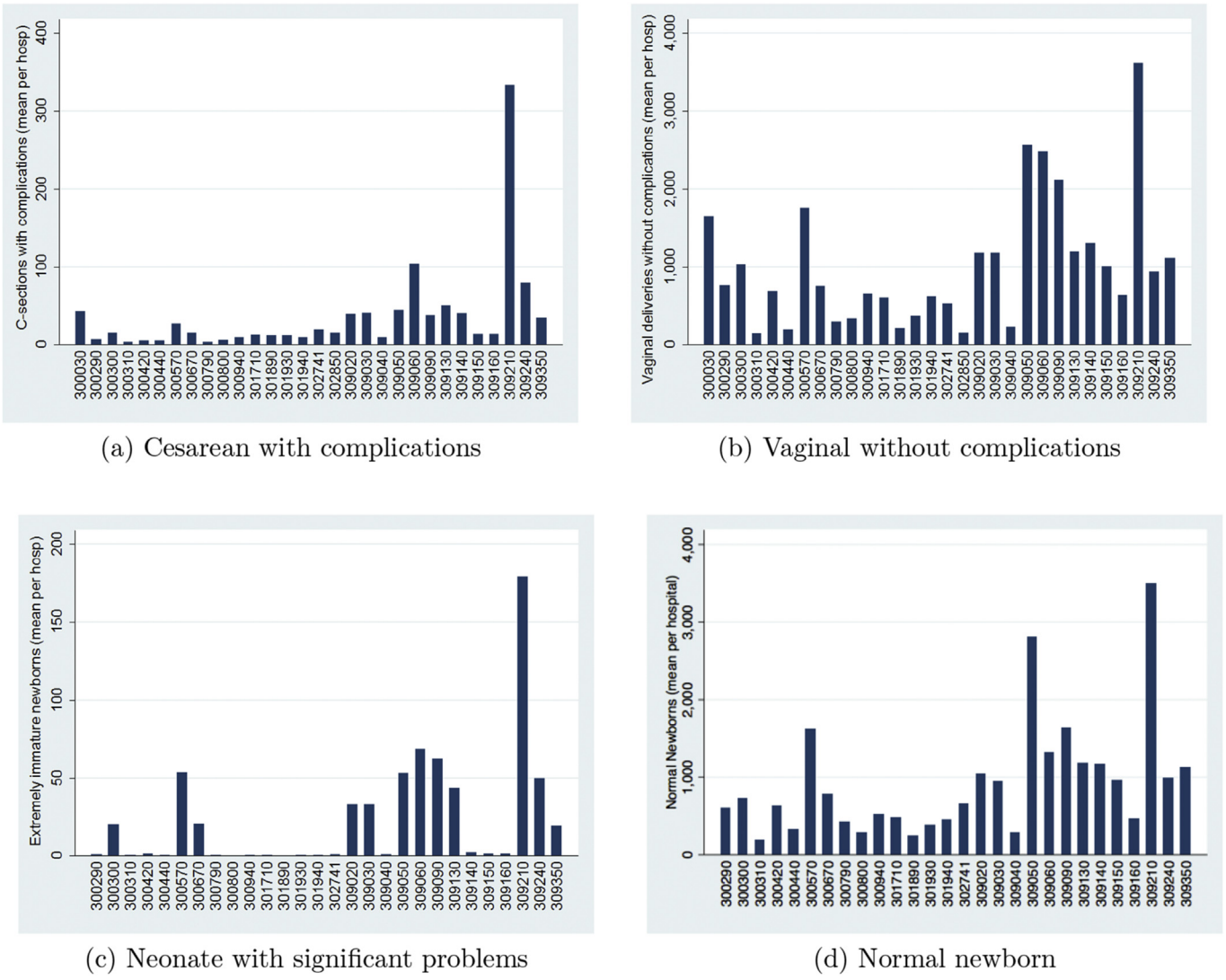

Fig. 2. Distribution of DRG per type and hospital (Lombardy).
Notes: The figures show the yearly distribution of DRGs per type of DRG and hospital between 2001 and 2013 in Lombardy. The vertical axis represents the average per hospital-year number of deliveries classified under DRG, the horizontal axis the hospital code.

have lower incentives to comply with a repayment plan, as they expect to be bailed out by the central government. As a consequence, we expect higher expenditures given government alignment and with more political parties.

We assess the importance of these political economy variables on DRG tariffs using two strategies. First, we exploit the panel structure of our dataset. This approach takes advantage of the within variation in the characteristics of regional governments triggered by regional elections to identify their impacts on the differences in the average levels of DRGs. We estimate the model described by Equation (1):

$$DRG_{irt} = Political\,Economy'_{rt}\delta + Cov1'_{rt}\sigma + Cov2'_{rt}\tau + \pi_r + \beta_t + \varepsilon_{rt} \quad (1)$$

where π_r are regional fixed effects, and β_t are year fixed effects. The vector *Political Economy′* includes the five variables described in the previous section, and their coefficients are our parameters of interest. $Cov1'_{rt}$ represents a vector of controls for the characteristics of the regional health care system normalized per thousand inhabitants, such as the number of public hospital beds, the number of public hospitals, the total personnel employed by the regional health care system, the number of physicians, and the regional GDP. The vector $Cov2'_{rt}$ groups the health characteristics of the regional population, which should explain the differences in the cost of providing the same treatments to people residing in different regions. As we are considering deliveries, we control for the incidence of heavy smokers, age of the mother, incidence of obesity, regional fertility, and miscarriage rates.

Second, we exploit the implementation of repayment plans to analyze whether the characteristics of regional governments affect the adoption of this policy with respect to DRG tariffs. In other words, we apply a difference-in-differences strategy in which the treatment is the adoption of a repayment plan, and we interact the treatment with each political economy variable. The intuition is that the policy aims to improve the efficiency of resource use in health care, so it should reduce waste in the price system. Thus, we want to evaluate the marginal effect of each political economy variable conditional on the adoption of a repayment plan by estimating the model described in Equation (2):

$$DRG_{irt} = \lambda Plan_{rt} + \alpha Plan_{rt}{*}Political\_Economy'_{rt} + Political\_Economy'_{rt}\delta + Cov1'_{rt}\sigma + Cov2'_{rt}\tau + \pi_r + \beta_t + \varepsilon_{rt} \quad (2)$$

where $Plan_{rt}$ is a dummy equal to 1 if region r has a repayment plan at time t, with $t \geq t^*$, and t^* is the year of plan adoption.

As noted above, the interpretation of the relationship between the political economy variables and the DRGs can be difficult. Certain characteristics of regional governments could lead to better assessment of the proper DRG tariff levels. However, we cannot calculate the "true" tariff per DRG; thus we follow a different approach to evaluate the effects (if any) detected through Equations (1) and (2). We estimate the same models using the quality indexes described in Section 3 as outcomes. If the characteristics of local governments are correlated with higher obstetric quality, they do not necessarily affect the markup component of the DRG price but its real value, as one is paying more for higher quality. Thus, we present the results of Equations (3) and (4) as follows:

$$Quality\ Index_{irt} = Political\ Economy'_{rt} + Cov1'_{rt}\sigma + Cov2'_{rt}\tau + \pi_r + \beta_t + \varepsilon_{rt} \quad (3)$$

$$Quality\ Index_{irt} = \lambda Plan_{rt} + \alpha Plan_{rt}{*}Political\_Economy'_{rt} + Political\_Economy'_{rt}\delta + Cov1'_{rt}\sigma + Cov2'_{rt}\tau + \pi_r + \beta_t + \varepsilon_{rt} \quad (4)$$

Table 2
The political economy of the DRG – mothers.

	With complications		Without complications	
Panel A: C-section				
	(1)	(2)	(3)	(4)
Plan	−94.672	−3.906	−396.616*	−429.380*
	(377.888)	(393.253)	(212.832)	(211.054)
Plan*Doctors	4482.826	3701.673	2803.350*	2692.204
	(2613.075)	(2865.320)	(1502.588)	(1718.562)
Plan*Graduates	−709.264	−629.363	−303.857	−182.487
	(944.643)	(814.055)	(539.708)	(522.982)
Plan*Non elected	−2324.777*	−2718.579**	−1986.231**	−2304.681***
	(1212.737)	(1076.938)	(791.038)	(789.918)
Plan*Aligned	139.228**	147.878**	123.711*	124.149*
	(58.198)	(54.559)	(64.175)	(67.800)
Plan* N. Parties	−8.146	−10.183	17.456	20.069
	(28.456)	(28.584)	(16.936)	(17.632)
Doctors	92.219	611.350	464.862	592.754
	(1065.834)	943.832)	(714.359)	(691.212)
Graduates	−75.400	−0.416	−342.083	−408.655
	(385.661)	(339.384)	(254.397)	(245.886)
Non Elected	167.672	160.910	558.969	601.389
	(954.360)	(927.295)	(642.090)	(655.673)
Aligned	−58.595	−69.110	−67.481*	−66.335
	(45.584)	(49.792)	(36.476)	(40.633)
N. parties	21.781	26.001	−4.112	−3.908
	(18.355)	(17.970)	(10.338)	(10.791)
R^2	0.936	0.938	0.912	0.913
Panel B: Vaginal delivery				
	With complications		Without complications	
Plan	−289.606	−368.519	−425.649**	−487.104***
	(257.284)	(269.520)	(167.210)	(173.618)
Plan*Doctors	2924.248	3277.960	1749.570**	2221.712**
	(1940.353)	(2,161.750))	(848.482)	(885.034)
Plan*Graduates	−861.237	−628.297	−401.616	−259.724
	(676.093)	(630.053)	(300.182)	(308.290)
Plan*Non elected	−971.075	−1229.137	−667.603	−657.571
	(889.253)	(829.676)	(606.009)	(630.683)
Plan*Aligned	187.468***	180.057**	157.954***	150.115***
	(63.659)	(65.117)	(53.734)	(53.915)
Plan*N. Parties	19.184	18.884	22.088*	19.810
	(19.359)	(20.263)	(11.782)	(12.242)
Doctors	1199.968	1191.415	1215.436*	1102.036*
	(887.738)	(738.763)	(686.004)	(585.257)
Graduates	−38.285	−184.655	−205.846	−306.999
	(215.757)	(214.986)	(180.027)	(192.826)
Non elected	361.941	310.462	−36.825	−124.519
	(553.188)	(545.347)	(298.119)	(295.415)
Aligned	−78.976**	−73.281*	−69.461**	−64.4558
	(36.260)	(40.929)	(32.071)	(35.119)
N. parties	−9.337	−7.900	−16.712*	−15.594
	(11.900)	(12.782)	(9.622)	(9.354)
R^2	0.915	0.917	0.906	0.908
Observations	294	294	294	294

Notes:Repayment plan is a dummy equal to 1 when the region has adopted a repayment plan and the year is equal to or later than the year of plan adoption. All models control for regional and year fixed effects and *Cov*1 and *Cov*2. Variables description in Table A6. Standard errors clustered at the regional level in parentheses. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

5. Results

The results from the panel fixed effects model are presented in Table 1. The results in the different columns correspond to the use of only Cov_1 (columns 1 and 3) and Cov_1 and Cov_2 (columns 2 and 4). Our preferred specifications are in columns (2) and (4), since they control for the characteristics of the treated population. Overall, the effect of the share of physicians in the regional government is

Table 3
The political economy of the DRG – newborns.

	Pre-Term or Respiratory Failure Newborn		Normal Newborn	
	(1)	(2)	(3)	(4)
Plan	−2421.159	−1564.834	−38.852	−18.192
	(2817.736)	(2729.223)	(60.762)	(62.435)
Plan*Doctors	35,148.585	29,941.048	504.193	525.688*
	(23,801.395)	(25,365.434)	(308.329)	(318.268)
Plan*Graduates	471.981	−655.117	−126.819	−82.654
	(6332.369)	(6642.345)	(109.083)	(110.865)
Plan*Non elected	−1586.017	383.847	−100.273	−127.388
	(7252.113)	(7398.293)	(220.217)	(226.801)
Plan*Aligned	−606.851	−483.204	37.738*	35.802*
	(1111.766)	(1098.003)	(19.526)	(19.388)
Plan*N. Parties	−17.665	−49.013	−0.171	−2.835
	(194.231)	(182.316)	(4.281)	(4.402)
Doctors	−3636.310	−576.726	361.433	398.071
	(7147.810)	(7494.353)	(259.504)	(273.319)
Graduates	−3896.401	−2517.222	−1.242	1.523
	(2967.780)	(3168.516)	(79.674)	(81.600)
Non elected	1487.810	987.908	−284.968	−338.810
	(5147.692)	(5025.114)	(266.257)	(278.881)
Aligned	−107.730	−247.299	−19.202**	−19.940**
	(293.186)	(345.105)	(8.736)	(9.182)
N. Parties	25.890	38.613	1.642	3.522
	(122.148)	(125.177)	(3.903)	(4.409)
R^2	0.695	0.632	0.709	0.723
Observations	294	294	294	294

Notes:Repayment plan is a dummy equal to 1 when the region has adopted a repayment plan and the year is equal to or later than the year of plan adoption. All models control for regional and year fixed effects and *Cov*1 and *Cov*2. Variables description in Table A6. Standard errors clustered at the regional level in parentheses. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 4
Results on quality indicators.

Panel A: Mother				
	Vaginal Complications		Cesarean Complications	
Doctors	−0.063	−0.064	0.010	0.008
	(0.079)	(0.079)	(0.052)	(0.053)
Graduates	0.021	0.020	0.010	0.008
	(0.033)	(0.032)	(0.018)	(0.017)
Non Elected	−0.015	−0.016	−0.060	−0.062
	(0.052)	(0.052)	(0.482)	(0.051)
Aligned	0.003	0.003	0.001	0.001
	(0.004)	(0.004)	(0.004)	(0.004)
N. Parties	0.001*	0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Low risk	No	Yes	No	Yes
Observations	273	273	273	273
Mean	0.131	0.131	0.064	0.064
R^2	0.654	0.655	0.334	0.335

Panel B: Newborn						
	Resuscitation Attempts		Vaginal Complications		Cesarean Complications	
Doctors	0.017	0.016	0.009	0.009	0.131	0.132
	(0.013)	(0.013)	(0.015)	(0.015)	(0.253)	(0.250)
Graduates	−0.003	−0.003	0.004	0.003	0.060	0.056
	(0.004)	(0.004)	(0.003)	(0.003)	(0.075)	(0.080)
Non Elected	−0.0001	−0.0003	0.005	0.006	0.215	0.218
	(0.007)	(0.007)	(0.008)	(0.008)	(0.180)	(0.187)
Aligned	−0.001	−0.001	−0.001	−0.001	0.014	0.014
	(0.001)	(0.001)	(0.001)	(0.001)	(0.021)	(0.021)
N. Parties	0.00005	0.00004	0.0001	0.0001	−0.004	−0.004
	(0.0002)	(0.0002)	(0.000)	(0.000)	(0.003)	(0.003)
Low weight	No	Yes	No	Yes	No	Yes
Observations	273	273	273	273	273	273
Mean	0.016	0.016	0.009	0.009	0.107	0.107
R^2	0.170	0.195	0.289	0.291	0.575	0.576

Notes: Data are available from 2001 onward. All models control for regional and year fixed effects and *Cov*1 and *Cov*2. Variables description in Table A6. Standard errors clustered at the regional level in parentheses. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 5
Results on inpatient quality indicators.

	VBAC Rate All		VBAC Rate Uncomplicated	
Doctors	−2074.354	−2134.127	−2109.452	−2179.519
	(1642.319)	(1618.833)	(1684.889)	(1657.910)
Graduates	312.026	256.655	328.584	263.480
	(742.413)	(758.138)	(774.056)	(790.668)
Non Elected	1571.679	1503.187	1685.426	1604.894
	(2607.137)	(2650.230)	(2726.156)	(2775.492)
Aligned	116.975	140.963	113.868	142.073
	(112.325)	(117.695)	(120.366)	(125.027)
N. Parties	34.713	30.139	32.095	26.717
	(44.747)	(45.423)	(46.897)	(47.689)
Low risk	No	Yes	No	Yes
Observations	273	273	273	273
Mean	6069.242	6069.242	6151.857	6151.857
R^2	0.738	0.743	0.730	0.735

	Primary C-sections Rate Uncomplicated		C-sections Rate Uncomplicated	
Doctors	−88.939	−42.730	−32.065	−6.129
	(54.858)	(44.129)	(50.137)	(43.494)
Graduates	3.155	19.798	10.123	19.464
	(14.858)	(13.547)	(14.715)	(13.757)
Non Elected	−29.803	24.414	−10.247	20.185
	(41.146)	(39.297)	(38.487)	(35.590)
Aligned	−3.844	−4.848*	−3.974	−4.538
	(2.973)	(2.740)	(3.086)	(3.115)
N. Parties	−0.034	−0.891	−1.211	−1.692*
	(1.048)	(0.816)	(0.988)	(0.892)
Low risk	No	Yes	No	Yes
Observations	273	273	273	273
Mean	228.266	228.266	341.173	341.173
R^2	0.455	0.660	0.492	0.567

Notes: Data are available from 2001 onward. All models control for regional and year fixed effects and *Cov*1 and *Cov*2. Variables description in Table A6. Standard errors clustered at the regional level in parentheses. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

always positive, but it is statistically different from zero only for vaginal deliveries and normal newborns. According to the estimated coefficients of our preferred specifications, a one-standard-deviation increase in the percentage of doctors (0.06) increases the average regional tariff for a vaginal delivery with complications by 3% at the mean of the variable (*i.e.*, 2813 euros in 2015 value) and by 4.7% if there are no complications. The same variation produces an increase of 4.9% for the normal newborn DRG. The percentage of college graduates is associated with lower tariffs, and it affects both vaginal (−1.8% at the mean of the variable) and cesarean without complications (−2.5%) at the 10% significance level.

Among the characteristics of regional governments considered, the incidence of physicians explains the bulk of regional variation in the DRG tariffs for vaginal deliveries and normal newborns. The number of physicians is especially important for treatments with lower technological investments, but it is totally irrelevant for severely premature newborns and c-sections. However, if the presence of physicians in the regional governments were affecting the quality of the system, we should have observed effects on all obstetric DRGs. Descriptive evidence can elaborate these results. Based on data from patients' discharge cards from the Lombardy region (10 million residents and, on average 77,691 annual deliveries), Fig. 2 plots the distribution of the two most and the two least technologically intensive obstetric DRGs across public hospitals. It is apparent that while c-sections with complications and severely premature newborns (*i.e.*, the most technologically intensive DRGs) are concentrated in a few hospitals, vaginal deliveries without complications and normal newborns (*i.e.*, the least technologically intensive) are more widely distributed. Therefore, when politicians increase less technologically intensive DRGs, they are redistributing money across all providers, which would not be the case when increasing the tariffs for more technologically intensive DRGs. To consider the role of technology and patient mobility, we also run the analysis on the DRGs for hip replacement and coronary bypass with the use of a catheter with and without a major cardiovascular diagnosis. These represent the two major diagnostic categories with the highest patient mobility in Italy (Agenas, 2012). No manipulation is detected and these results are available upon request.

The analysis of the panel fixed effects model provides initial evidence. To obtain a better picture, we turn to the analysis of the repayment plans. The average impact of the reform and the falsification tests used to prove the correctness of the assumptions of the DD approach are discussed in Appendix B. Tables 2 and 3 report the estimates of Equation (2) to derive the marginal effect of an increase of each political economy variable conditional on the adoption of a plan, controlling for the marginal effects of the other political economy characteristics. Two variables significantly affect the response to plan adoption: the incidence of physicians and the political alignment of regional and central governments. Among the other channels, the percentage of non-elected politicians in the regional government does affect the cesarean DRG tariff, and the direction of the effect is consistent with our expectations. In contrast to the panel analysis, this approach focuses on whether regional government characteristics affect how the government itself complies with a budget constraint policy, such as a repayment plan. Therefore, it is reasonable to expect some variables are significant in this scenario but not in the panel analysis.

Table 6
Results on quality indicators - DD.

	Panel A: Mother			
	Vaginal Complications		Cesarean Complications	
Plan	0.012	0.013	0.012	0.012
	(0.033)	(0.031)	(0.020)	(0.019)
Plan*Doctors	−0.043	−0.030	−0.093	−0.097
	(0.096)	(0.087)	(0.093)	(0.101)
Plan*Graduates	−0.123**	−0.126**	0.013	0.014
	(0.058)	(0.052)	(0.035)	(0.034)
Plan*Non Elected	0.013	0.007	−0.067	−0.070
	(0.092)	(0.099)	(0.081)	(0.083)
Plan*Aligned	0.013	0.013	−0.003	−0.003
	(0.009)	(0.009)	(0.005)	(0.005)
Plan*N. Parties	0.002	0.002	0.001	0.001
	(0.002)	(0.002)	(0.001)	(0.001)
Low risk	No	Yes	No	Yes
Observations	273	273	273	273
R^2	0.897	0.897	0.586	0.586

	Panel B: Newborn					
	Resuscitation Attempts		Vaginal Complications		Cesarean Complications	
Plan	0.006	0.005	0.008	0.008	−0.165	−0.185
	(0.005)	(0.005)	(0.005)	(0.005)	(0.156)	(0.160)
Plan*Doctors	−0.069	−0.065	−0.053	−0.053	0.321	0.393
	(0.044)	(0.039)	(0.031)	(0.031)	(0.355)	(0.362)
Plan*Graduates	0.017*	0.017**	−0.001	−0.001	−0.280	−0.270
	(0.009)	(0.008)	(0.008)	(0.008)	(0.208)	(0.214)
Plan*Non Elected	−0.014	−0.008	0.008	0.008	0.170	0.261
	(0.014)	(0.012)	(0.021)	(0.021)	(0.391)	(0.349)
Plan*Aligned	−0.001	−0.001	−0.001	−0.001	0.015	0.018
	(0.001)	(0.001)	(0.001)	(0.001)	(0.029)	(0.027)
Plan*N. Parties	−0.001	−0.001	0.00004	0.00004	0.012	0.012
	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.010)	(0.010)
Low weight	No	Yes	No	Yes	No	Yes
Observations	273	273	273	273	273	273
R^2	0.824	0.828	0.859	0.859	0.746	0.747

Notes: Data are available from 2001 onward. All models control for regional and year fixed effects and *Cov*1 and *Cov*2. Variables description in Table A6. Standard errors clustered at the regional level in parentheses. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 7
Results on inpatient quality indicators - DD.

	VBAC Rate All		VBAC Rate Uncomplicated	
Plan	−1439.868	1502.204	1566.105	1637.930
	(1281.851)	(1264.264)	(1351.772)	(1333.589)
Plan*Doctors	502.960	1921.063	59.107	1693.086
	(4845.555)	(4349.370)	(5074.661)	(4494.670)
Plan*Graduates	−2528.112	−2791.247*	−2437.475	−2752.189
	(1634.896)	(1566.511)	(1730.217)	(1653.795)
Plan*Non Elected	564.1959	−106.698	817.020	43.997
	(2777.934)	(2756.597)	(2897.282)	(2914.157)
Plan*Aligned	−201.998	−226.068	−209.215	−236.950
	(171.605)	(166.446)	(177.953)	(172.327)
Plan*N. Parties	2.930	7.447	−6.358	−1.154
	(88.669)	(85.969)	(92.658)	(89.707)
Low risk	No	Yes	No	Yes
Observations	273	273	273	273
R^2	0.951	0.952	0.949	0.950

	Primary C-sections Rate Uncomplicated		C-sections Rate Uncomplicated	
Plan	26.556	35.984*	23.837	29.430
	(29.243)	(18.925)	(28.668)	(23.405)
Plan*Doctors	−191.218	−55.404	−129.934	−49.378
	(150.623)	(84.221)	(120.386)	(111.011)
Plan*Graduates	3.601	−14.507	4.944	−5.796
	(41.143)	(27.838)	(35.927)	(32.742)
Plan*Non Elected	−128.956	−49.408	−38.895	8.288
	(100.366)	(84.087)	(86.891)	(95.667)
Plan*Aligned	8.769	7.651	5.703	5.040
	(9.874)	(8.216)	(8.745)	(7.870)
Plan*N. Parties	−0.513	−1.242	−0.600	−1.033
	(2.084)	(1.323)	(2.080)	(1.778)
Low risk	No	Yes	No	Yes
Observations	273	273	273	273
R^2	0.942	0.964	0.971	0.976

Notes: Data are available from 2001 onward. All models control for regional and year fixed effects and *Cov*1 and *Cov*2. Variables description in Table A6. Standard errors clustered at the regional level in parentheses. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

As shown in Table 2, conditional on the adoption of a repayment plan, an average incidence of *Doctors* (*i.e.*, 0.074) reduces the negative effect of a repayment plan by 8.6% on the average value of a DRG tariff for a vaginal delivery without complications (column 4). This means that the decrease in the DRG tariff triggered by the adoption of the plan is offset by the presence of doctors in the regional government. Specifically, for an average value of *Doctors*, the decrease in the DRG price is, on average, 164 euros (*i.e.*, 0.074*2221.712) smaller than it would have been otherwise (8.6% = 164/1,896,921). Similarly, with respect to the DRG for a normal newborn, the presence of doctors reduces the negative impact of a repayment plan by 2%. However, *Doctors* is not statistically significant for the other DRG outcomes. Again, these findings are consistent with the idea that *Doctors* might manipulate the tariffs of the most common and least technologically intensive procedures to redistribute wealth within the health care sector. In addition, *Aligned* plays a crucial role across all DRGs, with the exception of the DRG for severely premature newborns. Being politically aligned decreases the negative impact of a repayment plan on the DRG for c-sections with complications by 3.4%; for c-sections without complications by 2.6%; for vaginal with complications by 6.4%; and for vaginal without complications by 7.9%. The direction of the effect is the same for the normal newborn DRG, with a decrease in the impact of a plan of 5.8%. Regions that are not politically aligned with the central government tend to exhibit sharper decreases in all obstetric DRGs compared to politically aligned regional governments. This result supports the findings of a political economy literature that links equationment across levels of government to less respect for the rules. Finally, the proportion of non-elected politicians increases the effects of a repayment plan on the DRGs for c-section with complications by 3.7% and without complications by 4.5%.

Overall, the evidence presented thus far provides support for the effect of local governments on the average observed DRG tariffs. When we examine the results of Tables 4–7for Equations (3) and (4), no quality indicators considered is improved by any of the characteristics of regional governments. This means that none of the previously observed effects is significantly correlated with better health outcome measures.

6. Conclusions

Using a unique dataset of 21 obstetric DRG tariffs in Italy, we test whether the characteristics of the regional governments that are responsible for approving these prices play any role in determining their levels. This research question is relevant because DRGs are fixed prices for health care treatments, and they were conceived to reduce discretion and inefficient expenditure within the health care sector. If DRGs are truly computed on the basis of hospital production function, then changes in the political economy variables should not have a direct effect on their average

values. However, our analysis shows that the characteristics of the regional governments affect both average levels and compliance with a budget constraint policy. On average, the proportion of politicians in regional governments who are medical doctors plays an important role, especially for procedures that are more frequent and are less technologically complex. This seems to support the idea that politicians who are medical doctors tend to be more generous regarding the health care sector to increase support from their constituencies. Moreover, regarding the implementation of a budget constraint policy, such as a repayment plan, several of the political economy variables play a crucial role, including the share of medical doctors. The higher the share of medical doctors in the government, the weaker the commitment to undercut prices.

The use of patient discharge data also allows us to approximate the magnitude of the potential waste associated with our results. The analysis of the panel fixed effects model shows that a one-standard-deviation increase in the incidence of physicians on the regional council increases the DRG for vaginal deliveries with complications by 3%, the DRG for vaginal deliveries without complications by 4.7%, and the DRG for normal newborns by 4.9% at the mean of each variable. Although we are aware that these are imperfect proxies, we find no effect on the quality measures. Therefore the above effect seem to be associated with expenditures increases with no welfare gains. Given both the frequency and the average DRG price for these procedures/diagnoses in the period 2000–2013, the estimated increases correspond to additional expenditures of 8,373,429 euros (598,102 annually) for vaginal deliveries with complications, 328,153,980 euros (23,439,570 annually) for vaginal deliveries without complications, and 129,888,950 euros (9,277,782 annually) for normal newborns.

This is the first evidence that a system of standardized prices, such as a DRG system, is not immune to political pressures. We do not conclude that political manipulation renders the DRG system useless in combating health care sector inefficiencies. However, our findings show how the system can be manipulated when discretion can be used, highlighting the need for more stringent guidelines on price standardization at the local level when a national level tariff is in place. In this respect, it would be advisable to restrict local government discretion regarding DRG tariffs when it is more difficult to claim substantial local differences. In particular, more effort should be devoted to providing local authorities with common and clear instruments to identify the production function of hospitals and related costs rather than solely identify the costs that DRGs should cover.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2017.08.006.

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