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The Political Economy of Diagnosis-Related Groups

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Abstract

We provide a political economy interpretation of the variations in the prices of 6 obstetric diagnosis-related groups (DRGs) using Italy as a case study. Italy provides a unique institutional setting since the 21 regional governments can decide to adopt the national DRG system or to adjust/waive it. Using a panel fixed effects model, we exploit the results of 66 electoral ballots between 2000 and 2013 to estimate how obstetric DRGs are affected by the composition and characteristics of regional governments. We find that the incidence of physicians among regional politicians explains variations in DRGs with low technological intensity, such as normal newborn, but not of those with high technological intensity, as severely premature newborn. We further investigate these results by exploiting the implementation of a budget constraint policy. Applying a difference-in-difference strategy, we observe a decrease in the average levels of DRGs after the policy implementation, but the magnitude of this decrease depends on the presence of physicians among politicians and the political alignment between the regional and the national government. Finally, we rely on patient data (6,500,000 deliveries) to assess whether any of the political economy variables have a positive impact on the quality of regional obstetric systems. We find no effect.

JEL Classification: H51, H70, I1

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1 Introduction

Health care is a major component of GDP and a competence of local governments in decentralized or federal settings. There is a remarkable political economic literature on how multiple layers of government can 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 devoted 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). Bloom et al. (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 it is that a hospital will be closed in that district, as politicians do not wish to upset their constituents. This paper contributes to the literature inaugurated by Bloom et al. (2015). Our evidence is based on the relationship between political characteristics and the average levels of diagnosis-related groups (DRGs), particularly of 6 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 adopt DRGs is often left to local governments or insurers (Busse et al., 2011).[1] 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 DRG (APR-DRG), 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 seeks adjustments to better match

[1]By grouping procedures related to similar medical conditions and resource utilization, hospital activity can be expressed by standardized units that are comparable across providers. Once DRGs are defined, a fixed (average) price is assigned to each inpatient treatment based on cost data gathered from a set of selected hospitals. The DRG tariff is meant to represent the average costs of treating patients within the DRG and to be independent of the expenses incurred by any particular provider. Payments are made according to a calculated standard tariff per case; thus, hospitals' revenues depend on two factors: DRGs' prices and the number of discharged patients within each DRG. Finally, national health administrations provide a list of treatments and their DRG prices/tariffs. DRGs come with benefits and costs. The expected benefits include improving the transparency of health care services, and incentivizing cost containment by increasing both competition among health care providers and their efficiency (Davis and Rhodes, 1988; Brügger and Bruegger, 2010). DRGs generate costs because they can trigger the selection of the cheapest patients (*i.e.*, cream skimming and dumping) and favor upcoding practices (Ellis, 1998; Martinussen and Hagen, 2009; Kifmann and Siciliani, 2014; Barros, 2003). Moreover, they might slow the adoption of new technologies (Shih and Berliner, 2008; MedPAC, 2003).

the characteristics of its population and case mix.[2] 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 had some discretion on the timing of the adoption of the DRG system. In Germany, the development of DRGs is driven by provider associations and sickness funds, while Italian regions can conform to the national DRGs or set their own.

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, which cover the vast majority of obstetric procedures: 4 are related to deliveries (cesarean and vaginal with and without complications) and 2 related to newborns (severely premature and normal newborns). Obstetric DRGs offer several benefits for the empirical analysis. First, they are characterized by very low patient mobility across regions. Second, they refer only to inpatient treatments since the practice of home delivery is not common in Italy. Nevertheless, the differences in DRG prices across regions can be substantial. For instance, in 2000, a vaginal delivery without complications in Tuscany was paid almost 30% more than in the nearby Emilia Romagna, while the amount paid in Tuscany was almost 40% less than that in nearby Umbria. However, Umbria, Toscany, and Emilia Romagna have similar socio-economic characteristics and population health. Although there might be territorial differences in the costs of providing a procedure, the costs of certain inputs, such as personnel, do not vary across regions to an extent that would justify these differences.[3] Using panel data at the region-year level, we test the relevance of 5 features of regional governments to the variations in our DRG outcomes. The characteristics are the percentage of politicians with a medical degree, the percentage of politicians with college degrees, the percentage of people seated on the regional council but not elected through regional elections, a dummy for political alignment between the regional and national governments (*i.e.*, same political cohalition), and the number of parties represented in the regional council. Exploiting 10 regional elections between 2000 and 2013 (*i.e.*, 66 ballots), we estimate the impact of these variables on DRG prices. The expectations are intuitive. If the tariffs are not manipulated

[2]According to a recent press release by 3M, the company that manages the software used to calculate the APR-DRG, 23 states apply the APR-DRG system only for payments, 2 states only for reporting, and 5 states for payment and reporting. See `http://solutions.3m.com/wps/portal/3M/en_US/Health-Information-Systems/HIS/Products-and-Services/Products-List-A-Z/APR-DRG-Software/`.

[3]In Italy, both physicians and nurses are civil servants and are paid according to a so-called collective labor agreement (*Contratto collettivo nazionale - CCNL*) such as the CCNL 2002-2005 and the CCNL 2006-2009.

and are properly based on an objective analysis of the production functions of hospitals, these variables should not have any effect. However, our results show that the higher the proportion of doctors, the higher the average DRG tariffs for vaginal deliveries and normal newborns, that is, the procedures requiring less technological investment and are the most common in birth centers. Yet, there are at least two possible explanations for this effect. The effect could be a distortion relative to the optimal DRG price (*i.e.*, waste) or an improvement toward the optimal DRG price. For instance, an individual with a medical degree could be better skilled and have a better understanding of the implications of the use of standardized tariffs in the health care system. As a consequence, the presence of more doctors could affect the tariffs in a desirable way. If physicians in the regional government play a positive role in the assessment of the true DRG value, then it is difficult to understand why this effect is detected only in the most used and least technologically driven DRGs. To assess the type of manipulation in place, we follow two strategies. First, we exploit a policy introduced in Italy in 2006 that obliges regions with health care deficits to engage in a repayment plan. The goal of a repayment plan is to reduce the deficit through a general re-organization of the health care system. Since only some regions had to adopt a plan, we can implement a difference-in-differences strategy to assess the consequences of this policy at the DRG level. After demonstrating the absence of any anticipatory behavior and a negative average impact of a plan on DRG prices, we analyze the heterogeneous response to this policy conditional on the characteristics of regional politicians and governments. Our results suggest that stronger reductions for obstetric DRGs due to a repayment plan occur in regions with a lower share of medical doctors among regional politicians and when the regional and national governments are not politically aligned. Hence, where pressure groups are stronger and fiscal discipline is more difficult to enforce, the effect of a repayment plan is lower.

The second strategy exploits a unique dataset based on 6,500,000 patient discharge records related to a delivery released by the Italian Ministry of Health. We collapse them at the regional level to generate 9 proxies for obstetric quality: 4 inpatient quality indicators (2 related to vaginal deliveries, 2 to c-sections), 4 measures of the incidence of complications in vaginal and cesarean deliveries (2 for the mothers and 2 for newborns), and a measure of the incidence of resuscitation attempts on newborns. We show that neither higher percentages of physicians nor any other characteristics of the local government increase the quality of the obstetric system. However, a larger share of physicians among regional politicians is associated with higher average DRG prices.

The use of patient discharge data also allows us to approximate the magnitude of 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 (*i.e.*, 0.06) 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. These appear to be small increases. However, given both the frequency and the average DRG price for these procedures/diagnoses in the period 2000-2013, those increases correspond to additional expenditure equal to 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. According to our results, it would be advisable to restrict local government discretion on DRGs 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.

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 describes in detail the data used in the empirical analysis in Section 4. Section 5 presents the main results and the robustness checks. Section 6 concludes.

2 Institutions

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, there are 21 micro-health care systems in the country 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 both intra- and inter-regional mobility.

2.1 The DRG system

The Italian government released the first DRG tariffs list with Legislative Decree 169/1994, and since January 1995, all hospitals have been funded through a DRG-based system, which

is enforced for every patient (Cavalieri et al., 2013).[4] National tariffs were calculated based on data gathered from eight hospitals located in the Northern and Central regions without differentiating among hospital types (Fattore, 2006). Hence, teaching hospitals were assumed to have the same production function as non-teaching hospitals. The 1994 list was updated in 1997 (Legislative Decree n. 178/1997), 2006 (Decree of the Ministry of Health 12/09/ 2006), and 2012 (Decrees of the Ministry of Health 18/10/ 2012). At the present, there are 538 DRGs in the Italian system.

Sixteen regions implemented DRG systems soon after the release of the national list, while Emilia-Romagna, Abruzzo, and the Autonomous Province of Bolzen followed in 1996. Basilicata and the Autonomous Province of Trento were the last to do so in 1997. However, national tariffs only represented a benchmark, and regional governments could set their own rates and adjust them by hospital type. Consequently, the DRG-based funding mechanism was characterized by extensive differences across regions, which persist to the present (Assobiomedica (2010)).

The majority of regions have developed their own tariffs based on some type of cost assessment related to their own hospitals, whereas only a few have conformed with national tariffs (6 in 2000 and 2013). The differences between national and regional rates can be substantial. Figure 1 plots the ratios between the regional and national tariffs for two DRGs in 2000 and 2013: vaginal delivery without complications and normal newborn. Vaginal deliveries without complications are paid in a range between -20% up to +56% relative to the national rate, and the span is between -26% and +20% for payments related to a normal newborn. These huge variations cannot be explained by different technologies since these DRGs should not be substantially affected by the progress of medical science.

Figure 1 about here

2.2 The Repayment Plans 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 (so-called *Piani di rientro*).[5] These plans are enforced in the form of contractual agreements between the national and regional governments and imposed whenever the regional health

[4]When not specified otherwise, the term "providers" refers to hospitals.

[5]Health care expenditures account for approximately 90% of regional budgets. Regional governments have concurrent competences with the national government, including on environmental issues and education.

care deficit is equal to or exceeds 7% of the deficit in the previous year (Ministero della Salute, 2006b).

Under a repayment plan, a region must provide the central government with a credible plan for the re-organization of its health care system. Overall, the goal is to promote efficiency in the regional health care system while preserving a minimum level of assistance as established by national standards. Regions provide a list of measures foreseen in the plan[6] and they have to increase the regional tax rates.[7] In exchange, the central government allows them to access supplementary funds to improve their budget and ensure health assistance to their citizens. Regional governments should naturally dislike being under a repayment plan, as it limits their fiscal policy discretion.

Repayment plans began to be applied in 2007 and represent the principal tool to constrain the budgets of problematic regions.[8] Over time, the central government has imposed repayment plans on ten regions distributed in the Northern, Central and Southern areas of the country: Abruzzo, Campania, Lazio, Liguria, Molise, Sardinia and Sicily in 2007, Calabria in 2009, and Piedmont and Puglia in 2010.[9]

3 Data and Expectations

3.1 The Outcomes

DRG. Data on DRGs per region and year over the period 2000-2013 were collected through the analysis of regional legislation. We consider 6 DRGs strictly related to a delivery. Four of them refer to the mother: the DRGs for c-sections with and without complications and those for vaginal deliveries with and without complications. The remaining two are related to the newborn: the DRG for the case of severe prematurity (*i.e.*, pre-term conditions or serious respiratory problems) and that for a normal newborn.

We focus on deliveries for four reasons. First, deliveries are a procedure associated with

[6]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. This aim is to induce potential patients to rely more on (less expensive) outpatient clinics and encourage the distribution of drugs from hospitals directly to patients with chronic conditions.

[7]Regions manage an income surcharge rate (*i.e.*,*addizionale irpef*) and a regional tax on production *imposta regionale sulle attivita produttive*).

[8]For instance, according to Farmafactoring (2012), repayment plans are a successful instrument for costs containment. During the period 2007-2010, the average annual growth rate of health care expenditure was 2.4%, whereas this rate stood at 6.6% for the period 2001-2006.

[9]See Figure A.1 in the Online Appendix for the geographical distribution of regions bound by a plan.

low levels of patient mobility. Between 2001 and 2013, on average, only 3% of mothers moved to another region to give birth (Ministero della Salute (2006a), Ministero della Salute (2012)). This means that differences in prices should capture only differences in the cost of treating the local population and in the technological investment in the local system. Second, these 6 DRGs can be distinguished between those with high and low technological intensity. For instance, a vaginal delivery without complications is a procedure on which dramatic recent developments in medical science should not have had 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. At present, incubators allow doctors to perform most necessary medical checks without moving the baby, and if a transfer is necessary, there are special incubators that minimize the risk of injury. It is important to investigate whether these differences in technological intensity affect/constrain the manipulation of DRG tariffs. Third, deliveries refer to inpatient practices, 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 on both the mother (85% of all deliveries) and the newborn side (80% of all newborns) of deliveries. This means that we are considering the obstetrical procedures that are most likely to occur in a hospital regardless of the type of hospital.

A maximum of 11 of 21 regions diversify their DRG tariffs according to hospital type.[10] 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 A3 in the Appendix for an example of our dataset). On average, Italian regions pay their hospitals 1,897 euros (2015) for a natural delivery without complications, but 3,075 euros would be paid for the same delivery by c-section. When complications are present, these average rates increase to 2,813 and 4,379 euros, respectively. For a seriously premature birth, the average payment to the hospital is 16,101 euros, while it would receive 609 euros for a normal newborn delivery.[11]

Quality Indexes. Higher expenditures in health care do not necessarily coincide with waste and inefficiencies. Recent literature has shown that higher levels of expenditures in-

[10]For instance, the rates set with respect to hospitals belonging to the *A* category are generally the highest and are paid to teaching and research hospitals. However, this is not necessarily the case in all regions. For example, in Tuscany, these highest DRG tariffs are called the *D* category.

[11]Table A.5 in the Appendix A presents the descriptive statistics of our sample.

dicate better delivered care; see, for example, (Doyle and Kleiner, 2015) and (Doyle, 2011). Hence, even in the presence of manipulation by politicians, we need to verify the effect on the quality of obstetric practices. Higher rates for a given procedure could simply capture a higher average quality of the regional system.

We use a unique dataset of 6,500,000 deliveries recorded through patient discharge cards (*Schede di Dimissione Ospedaliera* or SDO) from the Italian Ministry of Health to construct a set of quality measures. First, we create the Inpatient Quality Indicators for obstetric practices suggested by the Agency for Health Research and Quality (AHRQ).[12] 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 those procedures for which there are questions of overuse, underuse, and misuse 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 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. We create 5 indexes: 3 for newborns and 2 for mothers. 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 these 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.[13] The underlying assumption is that the higher the incidence of these complications or resuscitation attempts or the lower the inpatient quality indicators, the lower is the obstetric quality of 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.[14] This allows us to control for very specific characteristics of the mothers popu-

[12]These data are only available from 2001 onward and come separately for mothers and newborns due to privacy reasons. There is a national program to monitor and evaluate Italian hospitals (*Programma Nazionale Esiti* or PNE). However, it only began in 2007, and the first years do not include all existing hospitals. Additionally, the PNE includes only indexes related to mothers while disregarding newborns. The most widely used index to assess the health status of newborns is the APGAR score, as measured at 1, 5 and 10 minutes after birth. This information is not publicly available for Italian hospitals.

[13]The number of deliveries and the number of newborns can differ due to both multiple pregnancies or stillbirths.

[14]Low-risk deliveries indicate births during which the mother did not suffer from any of the main risk

lation when using the quality indexes for mothers as outcomes. Analogously, we derive the incidence of low-weight babies (*i.e.*, below 1,500 grams) among newborns to control for risk factors that may explain the incidence of resuscitation attempts and complications among newborns.[15] If the risk factors of the underlying population are constant over time, the addition of a control for low-risk mothers or low-weight newborns should not affect the final results, as these characteristics are absorbed by regional fixed effects.

3.2 The Political Economy Variables and Their Expected Effects

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 are chosen and assigned to a specific area of competence by the governor of the region (*i.e.*, *presidente della regione*), who is elected by regional universal suffrage. Elections occur every 5 years and generate variations in the political variables. As shown in Table A4, we count 10 regional election waves between 2000 and 2013, for a total of 66 ballots. Most elections took place in the years 2000, 2005, and 2010, but they are staggered for some regions, such as those with a special statute.[16]

From the regional election results, we extract three proxies for the characteristics of regional politicians: the proportion of medical doctors (*Doctors*) among the regional politicians;[17] the proportion of politicians with college degrees other than physicians to measure their education level, often used as a proxy for quality (*Graduates*); and the proportion of politicians who are not elected (*Not elected*). A council member can be appointed by the region's governor even among professionals who have not been previously selected through elections. In addition, two variables, *Aligned* and *N parties*, proxy for the characteristics of the regional government. *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 the members of regional governments are doctors, 49% graduated college, and 6% are not elected. Approximately 45% of regional governments are aligned with the national government, and regional governments have an average of eleven parties.

factors complicating pregnancy and/or delivery (*e.g.*, multiple pregnancy, breech baby).

[15]Table A2, in the Appendix A, provides an accurate description of the variables and their sources.

[16]Regions with a special statute are established by the 1948 Italian constitution: Valle D'Aosta, Friuli Venezia Giulia, and the Autonomous Provinces of Bolzen and Trento, Sicily and Sardinia.

[17]We know whether they have a medical degree, but we are not able to recover their medical specialty.

To understand how the characteristics of local politicians and governments affect the average level of each DRG, we assume that the observed DRG for treatment i in region r at time t, DRG_{irt}, is the sum of two components, such that DRG_{irt}=$DRG'_{irt} + DRG^{*}_{irt}$. The "true" DRG tariff, DRG^{*}_{irt}, is a function of at least two sets of variables: the resident population characteristics and structural supply indicators such as the number of employees, the number of beds, and technological investments, which could make the provision of treatment i more or less expensive. DRG'_{irt} is essentially a mark-up price, which exists because it can be difficult to observe the true DRG value.[18] The political economy variables that we have selected could affect both components of the observed DRG_{irt}.

We expect that being a physician can affect the level of DRG in two ways. *Doctors* could directly influence DRG^{*}_{irt} because physicians could be more aware of the true costs and make better decisions when setting the price per treatment i. However, having more physicians could entail greater resources (i.e., higher rents) provided to the health care system, and thus, *Doctors* would affect DRG'_{rt}. More educated and less politically career-oriented members in the regional government should reduce the amount of DRG'_{rt}, and the observed DRG_{irt} should converge more toward the true value. Yet, unelected council members could still have re-election concerns, as the very fact of 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 associated with more public money availability and, potentially, more waste. The number of parties 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, in a decentralized state, when local governments are aligned with higher levels of government, they can benefit from more intergovernmental transfers (Arulampalam et al., 2009). Moreover, aligned regional governments could have lower incentives to comply with a repayment plan, as they expect to be bailed out by the central government. As a consequence, we could expect higher expenditure given alignment or more parties, as there is manipulation of the hidden part of the DRG (*i.e.*, higher DRG'_{rt}).

[18]By definition, this mark-up can only be a positive sum. Thus we assume that strategic behavior by politicians coincides with higher than optimal tariffs.

4 Empirical strategy

We assess the importance of the political economy variables on DRG tariffs by exploiting the panel structure of our dataset. This approach takes advantage of the within variation in the characteristics of regional politics triggered by regional elections to identify their impact on the differences in the average levels of DRGs. We estimate the model described by Equation 1:

$$DRG_{irt} = Political\ Economy_{rt}^{'}\delta + Cov1_{rt}^{'}\sigma + Cov2_{rt}^{'}\tau + \pi_r + \beta_t + \epsilon_{rt} \quad (1)$$

where π_r are the 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 health characteristics of the regional population, which should explain the difference 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, the age of the mother, the incidence of obesity, and the regional fertility and miscarriage rates.

As noted above, the interpretation of the relationship between the political economy variables and DRGs can be difficult. Certain characteristics of regional politicians or governments could mean a better assessment of the proper levels of DRGs. We cannot calculate the "true" tariff per type of DRG, and thus, we need to follow a different approach. First, we exploit the staggered implementation of repayment plans to analyze the political economy of the response to the adoption of this policy. In other words, we apply a difference-in-differences strategy in which the treatment is the adoption of a plan, and we investigate the heterogeneous reaction to the treatment conditional on each political economy variable. To address this first step, we use two models: one to estimate the average effect of a repayment plan on the different DRGs and another to measure the heterogeneities. We define $Plan_{rt}$ as a dummy equal to 1 if region r has a repayment plan at time t, with $t \geq t^*$, and t^* being the year of the plan adoption; the parameter estimated with the difference-in-differences model is λ as defined by Equation 2:

$$DRG_{irt} = \lambda Plan_{rt} + Cov1_{rt}^{'}\sigma + Cov2_{rt}^{'}\tau + \pi_r + \beta_t + \epsilon_{rt} \quad (2)$$

If the level of DRG adopted is far from the true one, politicians might want to reduce the gap (*i.e.*, the mark-up price). The broader the initial gap, the greater the margin for adjustment. Once we detect an average effect of the policy (if any), we focus on the response to the plan conditional on the characteristics of regional politicians and governments as described in Equation 3:

$$DRG_{irt} = \lambda Plan_{rt} + \alpha Plan_{rt} * D_{rt}^{'} + D_{rt}^{'}\delta + Cov1_{rt}^{'}\sigma + Cov2_{rt}^{'}\tau + \pi_r + \beta_t + \epsilon_{rt} \quad (3)$$

Where D is the dummy for each political economy variable based on the median value of the variable. For instance, when the variable is $Doctors$, D= 1 if the proportion of politicians who are also medical doctors is equal to or above the median of the distribution of $Doctors$, which is 0.063 (see Table 4). This means that the impact of the plan when D= 0 is λ, while $\lambda + \alpha$ provides the impact of the plan when D= 1, and α assesses the significance of the difference between the two samples.

As a second step, we check how the political economy variables are related to the set of quality indicators described in Section 3.1, estimating Equation 4. If the characteristics of local politicians are correlated with higher obstetric quality, they do not necessarily affect the mark-up part of the DRG price but its real value, as one is paying more for higher quality.

$$Quality\ Index_{irt} = Political\ Economy_{rt}^{'} + Cov1_{rt}^{'}\sigma + Cov2_{rt}^{'}\tau + \pi_r + \beta_t + \epsilon_{rt} \quad (4)$$

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 also

control for the characteristics of the treated population. Overall, the effect of the share of physicians in the regional government is always positive. Yet, it is different from zero only for vaginal deliveries and normal newborns. According to the coefficients estimated in 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.*, 2,813 euros) and by 4.7% if there are no complications. The same variation produces a greater impact equal to 4.9% for the DRG related to normal newborns. The percentage of college graduates is associated with lower tariffs, and it matters for both vaginal (-1.8% at the mean of the variable) and cesarean without complications (-2.5%) at the 10% significance level.

Table 1, about here

The analysis of the panel fixed effects model provides initial evidence. Among the characteristics of regional politics, the incidence of physicians explains the bulk of the regional variations in the DRG tariffs for vaginal deliveries and normal newborns. The number of physicians is especially important for treatments with lower technological investments, but they are totally irrelevant for severely premature newborns and c-sections. However, if the presence of physicians among local politicians were affecting the quality of the system, we should have observed an effect on all obstetric DRGs. Descriptive evidence can help to understand these results. Based on data from patients' discharge cards from the populous region of Lombardy (10 million residents, 77,691 average deliveries per year), Figure 2 plots the distribution across public hospitals of the two most and the two least technologically intensive obstetric DRGs. 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, and this would not be the case when increasing the more technologically intensive DRGs.[19] To obtain a better picture of the role of physicians in regional governments, we turn to the analysis of the repayment plans. Except for severe pre-term conditions affecting newborns, these plans have a negative impact on all obstetric DRGs, as shown in Table 2. The adoption

[19]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 major cardiovascular diagnosis. These represent the two major diagnostic categories characterized by the highest flows of patient mobility in Italy (Agenas, 2012). No manipulation is detected. The results are available upon request.

of a plan decreases DRGs for c-sections by between 7 (column 2) and 6% (column 4) and the DRGs for vaginal deliveries by between 6.7 and 8.8%. Nevertheless, the most robust result is for the DRG for normal newborns, which decreases by 8.6% at the mean of the variable. An average decrease indicates that there is room for adjustments in these tariffs. Table 3 reports the estimates of Equation 3 to indicate whether the observed average effect is driven by any of our political economy variables. It appears that two variables affect the response to plan adoption in a significant way: the incidence of physicians and the alignment between the regional and central governments.[20] Although the other channels do have an effect on some DRGs, this effect is not significantly different between subsamples.

Tables 2 and 3, about here

According to Table 3, the adoption of a repayment plan decreases each type of DRG in the subsample of regions in which the share of physicians in the regional government is lower, and it does not affect those regions with a higher incidence of physicians. The difference between the two samples is always statistically significant. The same effect is produced by *Aligned*: regions not aligned with the central government tend to decrease more or all obstetric DRGs, relative to politically aligned regional governments. This result supports the political economy literature that links alignment across different levels of government with less respect for the rules. Overall, the reduction in the DRGs triggered by the plans is lower whenever there are more physicians (*i.e.*, stronger pressure groups) in the regional government and the regional government is aligned with the central government.

The evidence thus far provides a straightforward interpretation of the role of local governments in determining DRGs, demonstrating the tendency to inflate the true DRG value. To further support this interpretation, we examine the results in Tables 4 and 5 for Equation 4. No quality indicators we consider are improved by any of the characteristics of local politicians or government. This means that the effects on the average DRG previously observed are not significantly correlated with better health outcome measures.

Tables 4 and 5 about here

6 Validity tests

There are two assumptions regarding the identification of the effect of repayment plans in Equation 2. First, the year a plan is adopted needs to be exogenous. The simple fact of

[20] We exclude from this analysis the DRG for severely premature newborns because the repayment plan does not produce any average effect on it.

implementing a plan might not be exogenous to the managerial and political skills available at the regional level. However, the regional government is forced to enroll in a repayment plan whenever a pre-set budget deficit threshold is exceeded. Conditional on bad managerial decisions, it seems plausible to assume that a repayment plan can be imposed on a region in any given year regardless of the DRG tariffs. Plans are not directly targeting the DRG levels but the overall organization of each regional health care system (*e.g.*, the number of beds for acute patients).

The second assumption is a common trend in the outcomes of interest for the treated and the control before the adoption of the policy. The usual graphical evidence for this untestable assumption is difficult given our institutional setting. Plans have been adopted in a staggered way, and thus there is more than 1 treatment year, t^*. To cope with this problem, we use the approach developed in Amaral-Garcia and Grembi (2014) and run permutation exercises in which the treatment year of the repayment plans (2007, 2009, and 2010) is randomly assigned to the control regions in 500 simulation trials.[21] We then plot the averaged values of the outcomes of interest of the simulated pre- and post-treatment trends for the control group. As shown in Figure 3, we consider 3 years before and 3 years after the treatment and set the year of adoption equal to 0. Overall, there is a decreasing trend in the series for both the treated and the controls due to the implementation of repayment plans. This is in line with the fact that to avoid the plans, each region needs to reduce inefficient expenditures. However, especially for vaginal delivery DRGs and the normal newborn DRG, the distance between control and treated regions increases over time.

Figure 3 about here

Finally, we test for any anticipatory behavior. The trends indicate a general decrease in the tariffs, but this might be evidence that regional governments anticipated the effect of repayment plans. Hence, we add to Equation 2 the leads of the repayment plan policy for the three years preceding the adoption of a plan. We provide the results only for those DRGs for which there is at least an average effect of the reform, that is, all but the pre-term newborn DRG. The results in Table 6 show a lack of anticipatory behaviors.

Table 6 about here

[21] There are 10 control regions. A control region has a 70% probability of being treated in 2007 (or 7 in 10), 10% probability of being treated in 2009 (or 1 in 10) and 20% probability to be treated in 2010 (or 2 in 10).

7 Conclusions

Using a unique dataset of 21 obstetric DRG tariffs in Italy, we test whether the characteristics of politicians and the government responsible for approving these tariffs play any role in their levels. DRG tariffs are introduced to reduce discretion and inefficient expenditure within the health care sector. Theoretically, their levels should be determined based on an objective hospital production function. However, our analysis shows that politicians play a role in defining standard prices in the health care system. The proportion of politicians with a medical degree plays an important role in every type of DRG. However, the discretion of politicians is more relevant for procedures that are more frequent and have lower technological complexity. We do not conclude that there is political manipulation that is rendering the system of standardized prices useless in combating inefficiencies in the health care sector. However, our findings show how the system can be played when discretion is allowed and highlight the need for more stringent guidelines on how to compute standardize prices at the local level.

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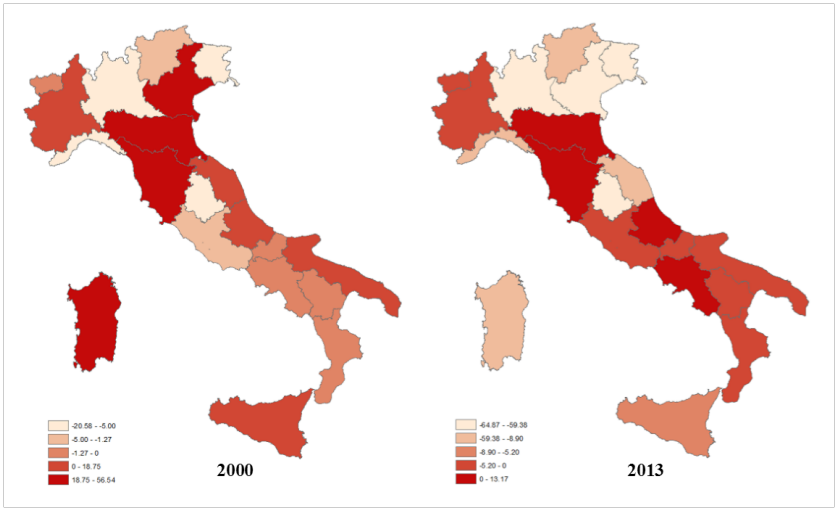
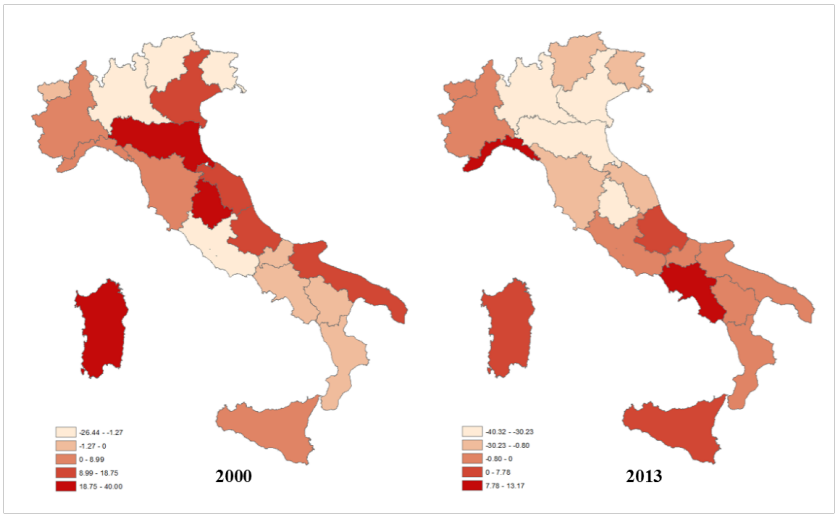
Figures and Tables

Figure 1: Differential Rate Between Regional and National DRGs

(a) Vaginal without complications

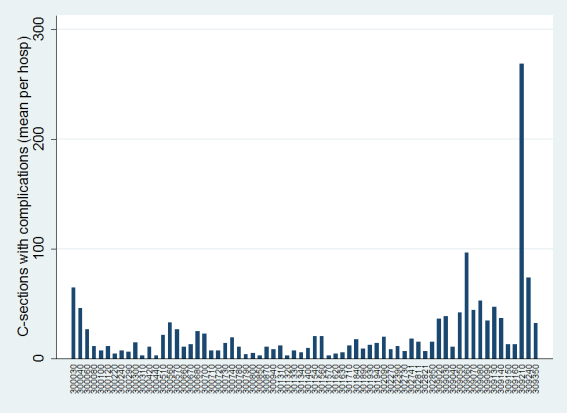


(b) Normal newborn

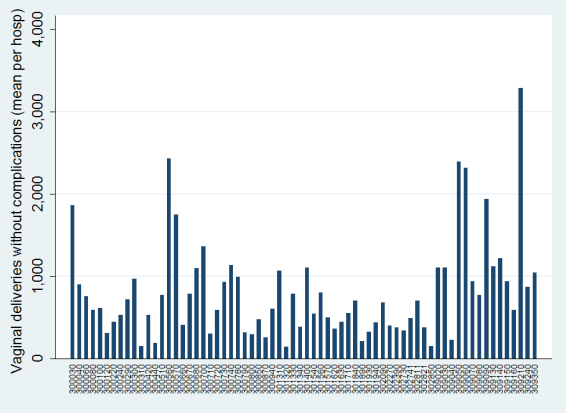


Notes: These figures depict the differential rate between regional and national tariffs. The darker the areas are, the higher the regional tariff compared to the national tariff.

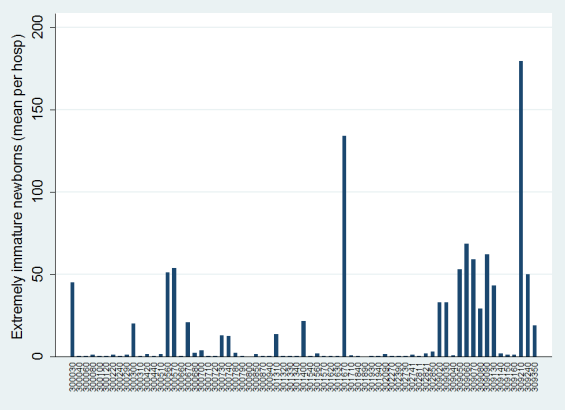
Figure 2: Distribution of DRG per type and hospital (Lombardy)



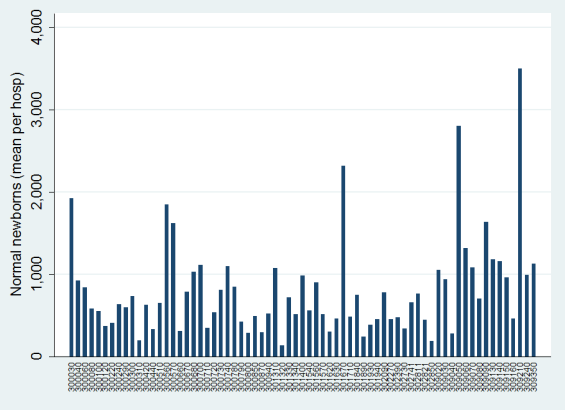
(a) Cesarean with complications



(b) Vaginal without complications



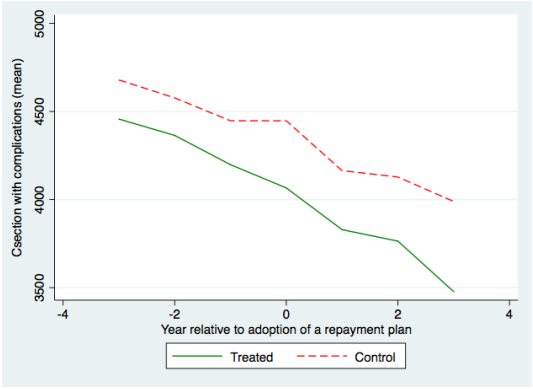
(c) Neonate with significant problems



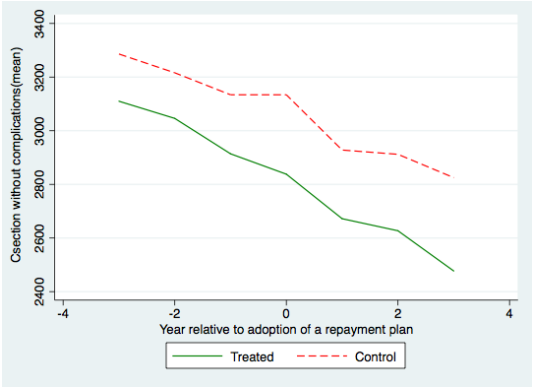
(d) Normal newborn

Notes: The figures show the yearly distribution of DRGs per type of DRG and hospital between 2001 and 2014 in Lombardy, one Italian region with 10 million inhabitants. The distribution is based on patient discharge cards (*i.e.*, Schede di dismissione ospedaliera).

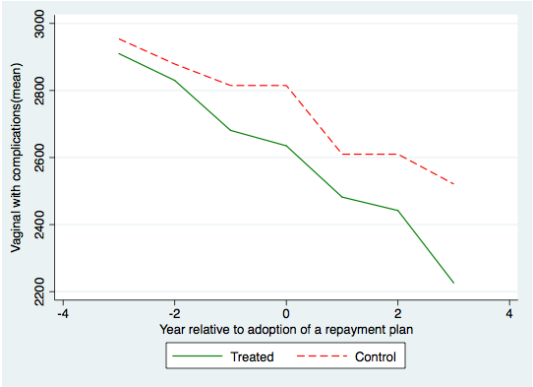
Figure 3: DRG trends conditional on repayment plans



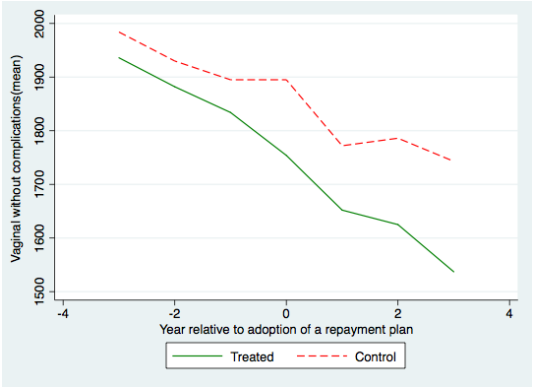
(a) Cesarean with complications



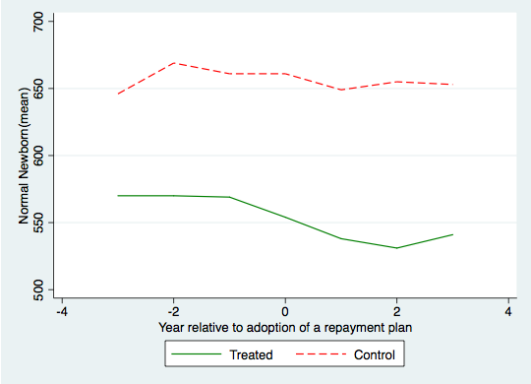
(b) Cesarean without complications



(c) Vaginal with complications



(d) Vaginal without complications



(e) Normal newborn

Notes: Mean DRG value of treated vs. control, treated being a region under a repayment plan. Year equal to 0 represents the year of repayment plan adoption. The averaged values for the controls are derived from 500 simulated trials in which the actual years of the treatment (*i.e.*, 2007, 2009, and 2010) are randomly assigned to the control regions.

Table 1: Panel Fixed Effects Results

Panel A: Cesarean section				
	With complications		Without complications	
	(1)	(2)	(3)	(4)
Doctors	799.709	1,250.607	948.295	1,068.728
	(1,076.603)	(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)
Panel B: Vaginal delivery				
	With complications		Without complications	
Doctors	1,616.290*	1,647.746*	1,552.737**	1,480.083**
	(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)
Panel C: Newborn				
	Pre-Term or Respiratory Failure Newborn		Normal Newborn	
Doctors	-11.576	4,003.384	457.224*	497.564**
	(7,024.834)	(7,550.175)	(233.552)	(230.793)
Graduates	-1,236.263	-650.825	-44.386	-27.733
	(2,586.706)	(2,319.206)	-337.130	-387.134
Non elected	831.887	1,020.692	(66.825)	(64.767)
	(4,792.487)	(4,531.566)	(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)
Observations	294	294	294	294

Notes: The results are from a panel fixed effects model region/year. All regressions include year fixed effects and the complete set of covariates. Models (1) and (3) control for $Cov1$; models (2) and (4) control for $Cov2$. 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 2: Difference-in-Differences Results

Panel A: Cesarean section				
	With complications		Without complications	
	(1)	(2)	(3)	(4)
Repayment Plan	-278.536**	-304.554**	-180.867*	-187.095*
	(125.968)	(116.941)	(95.201)	(99.495)
$Cov1$	✓	✓	✓	✓
$Cov2$		✓		✓
Mean	4,380	4,380	3,075	3,075
Panel B: Vaginal delivery				
	With complications		Without complications	
Repayment Plan	-214.355**	-188.130*	-179.281**	-166.762*
	(93.065)	(105.450)	(72.522)	(80.739)
$Cov1$	✓	✓	✓	✓
$Cov2$		✓		✓
Mean	2,813	2,813	1,897	1,897
Panel C: Newborn				
	Pre-Term or Respiratory Failure Newborn		Normal Newborn	
Repayment Plan	448.902	-92.534	-57.659**	-52.523**
	(787.693)	(794.885)	(21.725)	(19.250)
$Cov1$	✓	✓	✓	✓
$Cov2$		✓		✓
Mean	16,100	16,100	609	609
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 regressions include year fixed effects. 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 3: The Political Economy of the DRG

	Regional politicians compositions			Regional government Characteristics	
	Doctors	Graduates	Non Elected	Government Aligned	No. Parties
	(1)	(2)	(3)	(4)	(5)
Panel A: Cesarean section with complications					
	Less			No	Less
Repayment Plan	-513.011***	-285.738**	-246.028	-454.955***	-331.514**
	(98.483)	(119.967)	(147.659)	(105.969)	(155.707)
	More			Yes	More
Repayment Plan	-217.778	-394.056***	-362.632***	-253.176**	-337.727**
	(129.084)	(116.944)	(111.515)	(111.876)	(125.027)
Difference	295.233**	-108.318	-116.605	201.779***	-6.213
	(133.303)	(83.02)	(120.367)	(57.414)	(152.162)
Panel B: Cesarean section without complications					
	Less			No	Less
Repayment Plan	-272.877***	-177.222*	-80.98	-260.143**	-221.699
	(86.07)	(89.177)	(116.06)	(98.122)	(136.374)
	More			Yes	More
Repayment Plan	-101.873	-177.203	-216.402**	-132.21	-164.017
	(102.443)	(109.92)	(92.153)	(86.82)	(97.977)
Difference	171.003*	0.019	-135.422	127.932**	57.682
	(91.325)	(58.394)	(79.561)	(46.319)	(118.775)
Panel C: Vaginal delivery with complications					
	Less			No	Less
Repayment Plan	-285.961***	-157.048	-130.023	-268.479**	-256.541*
	(87.519)	(107.625)	(105.628)	(103.601)	(130.058)
	More			Yes	More
Repayment Plan	-75.97	-173.25	-178.773	-94.992	-130.378
	(121.501)	(109.175)	(112.319)	(105.418)	(112.788)
Difference	209.991*	-16.202	-48.749	173.487***	126.164
	(119.031)	(61.149)	(81.904)	(50.164)	(124.827)
Observations	294	294	294	294	294
Median	0.063	0.500	0.048	0	11

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. In models (1), (2), (3), and (5) *Less* stands for a below-median value and *More* stands for an above-median value. In model (4), *No* indicates that the regional government is not aligned (*i.e.*, same political affiliation) with the national government and *Yes* that it is aligned with the national government. All models control for regional and year fixed effects and $Cov1$ and $Cov2$. The explanation for each variable is in Table A.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 ***.

Table 4: The Political Economy of the DRG (cont'd)

	Regional politicians compositions			Regional government Characteristics	
	Doctors	Graduates	Non Elected	Government Aligned	No. Parties
	(1)	(2)	(3)	(4)	(5)
Panel D: Vaginal without complications					
	Less			No	Less
Repayment Plan	-256.822***	-177.178**	-157.56**	-238.046***	-219.404**
	(55.941)	(75.787)	(67.832)	(83.192)	(90.932)
	More			Yes	More
Repayment Plan	-90.422	-143.618*	-164.909*	-115.673	-148.668*
	(77.756)	(73.139)	(81.567)	(69.63)	(80.15)
Difference	166.4***	33.56	-7.349	122.373**	70.736
	(55.553)	(36.017)	(52.088)	(45.173)	(87.996)
Panel E: Normal Newborn					
	Less			No	Less
Repayment Plan	-66.151***	-35.734	-51.667*	-65.337***	-43.266
	(21.388)	(22.296)	(26.129)	(21.704)	(31.084)
	More			Yes	More
Repayment Plan	-21.959	-55.458*	-39.897*	-31.815	-45.23**
	(21.761)	(26.846)	(21.669)	(18.554)	(19.842)
Difference	44.193*	-19.725	11.77	33.522**	-1.965
	(23.526)	(29.273)	(23.435)	(13.699)	(28.355)
Observations	294	294	294	294	294
Median	0.063	0.500	0.048	0	11

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. In models (1), (2), (3), and (5) *Less* stands for a below-median value and *More* stands for an above-median value. In model (4), *No* indicates that the regional government is not aligned (*i.e.*, same political affiliation) with the national government and *Yes* that it is aligned with the national government. All models control for regional and year fixed effects and $Cov1$ and $Cov2$. 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

Panel B: Newborn

	Resuscitation Attempts		Vaginal Complications		Cesarean Complications	
Doctors	0.017	0.018	0.009	0.009	0.131	0.132
	(0.016)	(0.016)	(0.015)	(0.015)	(0.253)	(0.250)
Graduates	-0.001	-0.002	0.004	0.003	0.060	0.056
	(0.005)	(0.005)	(0.003)	(0.003)	(0.075)	(0.080)
Non Elected	-0.001	-0.000	0.005	0.006	0.215	0.218
	(0.009)	(0.009)	(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	0.000	0.000	0.000	0.000	-0.004	-0.004
	(0.000)	(0.000)	(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

Notes: Maternal complications include delivery and postpartum complications. *Low risk*=Vaginal (Cesarean) low-risk deliveries over total vaginal (cesarean) deliveries; *Low weight*= low-weight newborns over total newborns. Data are available for the period 2001-2013. All models control for regional and year fixed effects and $Cov1$ and $Cov2$. 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	-2,074.354	-2,134.127	-2,109.452	-2,179.519
	(1,642.319)	(1,618.833)	(1,684.889)	(1,657.910)
Graduates	312.026	256.655	328.584	263.480
	(742.413)	(758.138)	(774.056)	(790.668)
Non Elected	1,571.679	1,503.187	1,685.426	1,604.894
	(2,607.137)	(2,650.230)	(2,726.156)	(2,775.492)
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	6,069.242	6,069.242	6,151.857	6,151.857

	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

Notes: All inpatient quality indicators are computed following the AHRQ's guidelines and are expressed per 1,000 deliveries. $VBAC$= Vaginal Birth after Cesarean. *Low risk*=Vaginal (Cesarean) low-risk deliveries over total vaginal (cesarean) deliveries. Data are available for the period 2001-2013. All models control for regional and year fixed effects and $Cov1$ and $Cov2$. 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 6: Diff-in-Diff. Falsification

Panel A: Cesarean section

	With Complications (1)	Without Complications (2)
Lead 3	-34.055	20.359
	(126.125)	(83.225)
Lead 2	-10.247	36.034
	(150.146)	(101.242)
Lead 1	-127.046	-68.400
	(130.576)	(94.590)
Repayment Plan	-334.196**	-193.432
	(146.429)	(117.672)
Observations	294	294

Panel B: Vaginal delivery

	With Complications	Without Complications
Lead 3	-12.629	-3.362
	(86.657)	(58.610)
Lead 2	-13.452	-19.760
	(110.054)	(75.139)
Lead 1	-104.990	-46.752
	(111.870)	(60.524)
Repayment Plan	-204.343	-175.170*
	(121.901)	(89.699)
Observations	294	294

Panel C: Newborn

	Normal Newborn
Lead 3	-10.312
	(19.806)
Lead 2	-32.019
	(33.111)
Lead 1	-35.052
	(28.280)
Repayment Plan	-65.996**
	(24.582)
Observations	294

Notes: *Leads*3=three years before the adoption of the repayment plan. All regressions include year and region fixed effects, as well as both $Cov1$ and $Cov2$. 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 ***.

Appendix A: Additional Figures and Tables

This Appendix provides additional information and robustness checks, which are also discussed in the paper. In particular, we present the following:

- Targets and recommended policy measures adopted by a repayment plan (Table A1);
- Characteristics and sources of the variables we use (Table A2);
- Example of a regional DRG schedule (Table A3);
- Number of elections per region/year (Table A4);
- Distribution of the regions under a repayment plan (Figure A1); and
- Descriptive statistics (Table A5).

Table A.1: Targets and measures included in a repayment plan

Targets	**Planned Measures**
Hospitals beds and hospitalisation rates	Reorganisation of the hospital network Reduction of hospital beds Incentives to use outpatient clinics
Pharmaceutical expenditures	(Hospital) Direct distribution of drugs New reimbursement mechanisms for less expensive drugs
Personnel expenditures	Hiring freezing and turn-over stop
Volume and expenditure for private provided services	Set budget targets for private providers Adjusting the reimbursement system to the national level
Expenditures for consumption goods and services	Centralised buying Monitoring to avoid inefficiency
Appropriate prescriptions	Use of health identification cards

Source: Ministero Economia e Finanza (2009).

Table A.2: Variables' description and sources

Variable	Definition and measure	Years	Source
Doctors	Share of doctors within the regional council	2000-2013	IMI
Graduates	Share of graduated members within the regional council	2000-2013	IMI
Alignment	Dummy equal to 1 if the regional government has the same political color of the central government	2000-2013	IMI
Not Elected	Proportion of council member directly appointed by the president of the region and not elected through the regional elections	2000-2013	IMI
N. Parties	Number of Parties in the Regional Government	2000-2013	IMI
Beds	Number of hospital beds per 1,000 inhabitants (public or all?)	2000-2013	MoH
Hospitals	Number of hospital per 1,000 inhabitants	2000-2013	MoH
Personnel in the Healthcare	Number of workers employed by public hospitals per 1,000 inhabitants	2000-2013	MoH
Physicians	Number of doctors employed by public hospitals per 1,000 inhabitants	2000-2013	MoH
Gdp	Average gdp at the regional level (2015 Euros)	2000-2013	ISTAT
Age mother	Average age of pregnant women	2000-2013	ISTAT (HFA)
Fertility	Average number of children per woman	2000-2013	ISTAT (HFA)
Heavy Smokers	Proportion of resident population older than 15 smoking more than 20 cigarettes per day out of the resident population	2000-2013	ISTAT (HFA)
Obese	Proportion of resident population older than 18 and obese	2000-2013	ISTAT (HFA)
Miscarriage rate	Share of miscarriages out of total deliveries	2000-2013	ISTAT (HFA)

Notes: All the variables are at the regional level. IMI stands for the Italian Ministry of the Interior. $ISTAT$ stands for the Italian National Institute of Statistics, which collects the Health For All (HFA) dataset. MoH stands for the Italian Ministry of Health.

Table A2: Variables' description and sources (cont'd)

Variable	Definition and measure	Available	Source
Quality Indexes			
Vaginal Complications	Proportion of maternal or newborns complications related to a vaginal delivery	2001-2013	MoH
Cesarean Complications	Proportion of maternal or newborns complications related to a cesarean delivery	2001-2013	MoH
Resuscitation Attempts	Incidence of newborns who required a resuscitation attempt out of the total number of newborns	2001-2013	MoH
Low-risk	Incidence of low-risk cesarean (vaginal) deliveries out of the total number of cesarean (vaginal) deliveries	2001-2013	MoH
Low-weight	Incidence of low weight newborns out of the total number of newborns	2001-2013	MoH
VBAC Rate All	Vaginal births per 1,000 deliveries by patients with previous Cesarean deliveries	2001-2013	MoH
VBAC Rate Uncomplicated	Vaginal births per 1,000 deliveries by patients with previous Cesarean deliveries. Excludes deliveries with complications (abnormal presentation, preterm delivery, fetal death, multiple gestation diagnoses)	2001-2013	MoH
Primary C-section Rate Uncomplicated	First-time Cesarean deliveries without a hysterotomy procedure per 1,000 deliveries. Excludes deliveries with complications (abnormal presentation, preterm delivery, fetal death, multiple gestation diagnoses, or breech procedure)	2001-2013	MoH
Primary C-section Rate Uncomplicated	Cesarean deliveries without a hysterotomy procedure per 1,000 deliveries. Excludes deliveries with complications (abnormal presentation, preterm delivery, fetal death, multiple gestation diagnoses)	2001-2013	MoH

Notes: All the variables are at the regional level. $ISTAT$ stands for the Italian National Institute of Statistics, which collects the Health For All (HFA) dataset. MoH stands for the Italian Ministry of Health.

Table A.3: Example of DRG schedule

Hospital Category	DRG number	Value	Average Value
A	370	x_1	$\frac{\sum_{j=1}^{3}(x_j)}{3}$
B	370	x_2	
C	370	x_3	

Notes: DRG 370 is the DRG for c-section with complications. In our dataset, we have 11 regions adopting differentiated tariffs per hospital type.

Table A.4: Elections during our observation period

Region	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Valle d'Aosta				✓					✓					✓
Piemonte	✓					✓					✓			
Lombardia	✓					✓					✓			
Bolzano				✓					✓					✓
Trento				✓					✓					✓
Veneto	✓					✓					✓			
Friuli Venezia Giulia				✓					✓					✓
Liguria	✓					✓					✓			
Emilia Romagna	✓					✓					✓			
Toscana	✓					✓					✓			
Umbria	✓					✓					✓			
Marche	✓					✓					✓			
Lazio	✓					✓					✓			
Abruzzo	✓					✓					✓			
Molise		✓					✓					✓		✓
Campania	✓					✓					✓			
Puglia	✓					✓					✓			
Basilicata	✓					✓					✓			✓
Calabria	✓					✓					✓			
Sicilia		✓					✓		✓				✓	
Sardegna				✓					✓					✓

Notes: Data from the regional elections are available from the Italian Ministry of the Interior.

Figure A.1: Regions adopting repayment plans

Notes: Dashed areas are regions under a repayment plan between 2000 and 2013.

Table A.5: Descriptive Statistics

	Mean	Std. Dev.	Obs.
Outcomes			
A) Average DRG Tariffs			
Cesarean with complications	4,379.885	961.270	294
Cesarean without complications	3,075.142	641.695	294
Vaginal with complications	2,812.802	649,417	294
Vaginal without complications	1,896.921	456,484	294
Pre Term or Respiratory Failure Newborn	16,099.825	4,085.046	294
Normal Newborn	609.127	94.493	294
B) Quality Indexes			
Resuscitation Attempts Newborn	0.016	0.009	273
Vaginal Complications Newborn	0.009	0.009	273
Cesarean Complications Newborn	0.107	0.173	273
Vaginal Complications Mother	0.131	0.059	273
Cesarean Complications Mother	0.064	0.026	273
VBAC Rate All	6,059.242	2,703.567	273
VBAC Rate Uncomplicated	6,151.857	2,793.805	273
Primary C-section Rate Uncomplicated	228.266	68.949	273
C-section Rate Uncomplicated	341.173	87.761	273
Regional Politicians			
Doctors	0.074	0.059	294
Graduates	0.493	0.097	294
Non elected	0.060	0.052	294
Regional Government			
Aligned	0.446	0.498	294
N. of parties	10,963	3.189	294
Regional Healthcare system			
Beds	3.653	0.679	294
Hospitals	0.013	0.006	294
Doctors in public hospitals	2.006	0.286	294
Medical Staff	6.936	0.965	294
Total Personnel	13.504	1.876	294
Personnel	12.515	2.079	294
Regional Population			
Age of the mother	31.312	0.763	294
Fertility	1.313	0.141	294
Heavy Smokers	7.624	2.405	294
Obese	9.799	1.583	294
Miscarriage rate	167.668	28.508	294
Gdp	81,376.781	84,211.219	294

Notes: DRG values are in 2015 euros. For a description of the variables, see Table A.2 in Appendix A.