Political stability and relational contracts

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very preliminary version

July 24, 2019

Abstract

We study a repeated interaction between a purchaser and provider of the health service when some aspects of the service are unverifiable. We formalize a relational contract inducing the provider to deliver a required unverifiable level of quality and find that the higher the stability of the interaction between them the higher the willingnes to deliver unverifiable quality. Using political stability as proxy of this stable interaction, we empirically test this relationship by focusing on cesarean sections. We refer to the Italian context looking at the C-section rates from 1996 to 2016 at the regional level. Though a standard OLS approach and controlling for health, socioeconomic, supply and contractual factors, we find that the C-section rates are lower in contexts where regional governments are more stable.

Keywords: relational contract; C-section; political stability

JEL codes: H57, L41, C73

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1 Introduction

The provision of unverifiable quality is a major issue in the healthcare sector given the peculiar agency relationship among providers (hospital, doctor) and purchasers (the payer of the service such as national or local government). The unverifiable nature of some aspects of the healthcare system makes impossible to formalize standard contractual clauses enforced by the power of an independent court of law. The professional autonomy along with the impossibility to perfectly verify the patients' condition or the complexity of some medical treatments make this issue crucial, especially for some clinical areas. When medical performance and treatments are not verifiable, no self enforcing contract is possible to induce the provider to deliver a satisfactory service. The lack of verifiability is quite problematic especially if we look at the real enforcing power of the several payment/schemes commonly applied in the health sector between providers and health decision makers paying for the delivery of the service.

Attempts to handle non-contractible quality in the health service have been characterizing the most recent literature and one one hando our paper is one of these. On the other hand, we also aim to get a further step in the current debate by proposing a new perspective to look at the issue, that is, quite surprisingly, show how the enforcing of quality in the health system may depend on political scenario. To build a bridge between health and political economy we introduce relational contracting in the health sector. Following Levin (2003), we formalize a relational contracting as agreements whose enforcing does not come from the power of an external court, as for the complete contracts with contractibile tasks, but from the value providers and purchasers of the health service give to their future interaction.[1]

Our paper is two fold: first we theoretically set up a contractual agreement able to induce the incentive to deliver the final service even when it includes unverifiable tasks, second we empirically confirm that the incentive power of such a contract depends on the political stability of the health decision maker that is usually a local or national government.

In the first part of the paper we set up a dynamic scenario (as an infinitely repeated game) in which one non-altruistic provider and one purchaser agree on a *Pay for Performance-Relational Contract* (P4P-RC) to provide both unverifiable ana verifiable quality component of the health service. We characterize a *Pay for Performance-Relational Contract* (P4P-RC) entailing a per-unit price of quality plus a fixed transfer as a dynamic version of standard static P4P scheme.[2] Not surprisingly we find that a P4P-RC induces a positive unverifiable quality, whereas in the static game a standard P4P scheme does not. We

[1] Relational contracts have been pioneered by Bull (1987) and MacLeod and Malcomson (1989) and applied in several fields: labour market (MacLeod, 2003; Levin, 2003; and Li and Matouschek, 2013), interaction between/within firms (Baker et al., 2002; and Rayo, 2007; Taylor and Plambeck 2007; Andrews and Barron 2016; Calzolari et al 2017), regulation (Cesi et al., 2012) and experimental economics (Fehr and Schmidt, 2007; Bigoni et al., 2014); procurement (Albano et al 2017 (a,b); Spagnolo and Calzolari 2009; Doni 2006), see also Malcomson (2013) for an extensive discussion.

[2] AGGIUGERE LETTERATURA EMPIRICA E NON PER VALIDARE TALE IPOTESI

also show that a P4P-RC induces a distortion from the first best qualities even though the price follows the first best condition. In particular, it induces an upward bias in the optimal condition for the unverifiable quality. Regarding the verifiable quality, the distortion from the first best depends on the complementarity/substitutability between qualities. In general, a P4P-RC induces an over-provision (lower-provision) of verifiable quality when both types of quality are technical substitutes (complements). More surprisingly, with no technical relation, the level of verifiable quality follows the first best conditions. We also find that when both the provider and the purchaser are sufficiently patient and care about the stability of their interaction over run the first best price and qualities are obtained. In terms of policy implications this result shows that a P4P-RC replicates the first best quality and price when the same provider and purchaser are able to frequently interact in the future. Theoretically speaking, in the common jargon of repetaed games, the political stability is measured by the high discount factor.

Eggleston (2005) and Kaarboe and Siciliani (2011) are the most recent works to study the incentive scheme able to induce providers to deliver both verifiable and unverifiable quality.[3] Eggleston (2005) stresses the necessity of a payment scheme able to deal with this issue, as she writes "*Mixed payment's advantage of balancing incentives for quality effort across contractible and non-contractible dimensions of quality has not heretofore been highlighted (as far as I am aware). Yet this link deserves attention, especially as more employers and other purchasers include measures of provider performance in payment contracts.*" After discussing examples of unverifiable quality in the health system in the UK and US she introduces a P4P scheme as device to enforce not contractible quality, as she writes "*Since arguably some dimensions of quality will never be contractible, introducing selective pay-for-performance actually heightens the need for mixed payment—to balance incentives for dimensions of quality that complement treatment.*" Eggleston shows that a P4P-program may increase the verifiable quality dimension (which will increase patients' benefit), but may decrease the non-verifiable level (which will reduce patients' benefit) and the overall welfare effect is ambiguous. Kaarboe and Siciliani (2011) extend the model of Eggleston (2005) studying a P4P scheme in a static scenario by setting up a sequential game between a purchaser of the health service and a altruistic provider where the former firstly sets a payment to the latter for each unit of quality plus a fixed transfer, then the provider, as second mover, sets qualities, verifiable and unverifiable.

From a theoretical perspective our dynamic P4P-RC fills the gap in Eggleston (2005) and updates Kaarboe and Siciliani (2011), although we provide different predictions from the latter. Our empirical results are the second pillar of the contribution. By using data from the Italian Regional Health Service system we find that the efficient level of unverifiable services is obtained when the identity of the political administration remains stable over time. We base

[3] Beitia (2003) studies the optimal market structure, oligopoly or monopoly, in a context of unverifiable quality by letting the regulator to use a two-part tariff in which the hospital is paid a variable part depending on the number of patients choosing the hospital.

our empirical analysis on the medical decisions concerning the children delivery, that are certainly one of the most prominent examples of unverifiability in the health service. Actually, the choice of opting for Cesarean sections (C-section henceforth) should be driven by the mother's conditions, but the doctor's autonomy allows the physician to argue that the C-section is appropriate even when is not, and the purchaser has no chance to verify the truthfulness of the medical decision. On the other hand, being the C-section reimbursed at a higher tariff than natural delivery, there might be an incentive for the hospital to overprovide C-sections especially when the general conditions of the patients are good and the surgical operation is less likely to become complicated. It has been shown that in this case, also the hospital's ownership matters. In Italy, where the provision of C-sections is very heterogeneous across regions- suggesting that provision might be inappropriate in certain regional contexts- many attempts have been done by policy makers to give incentive to hospitals to provide an appropriate amount of C-sections, such as setting volume caps to the lifting of the tariff beyond a certain level of provision. The aim of this study is not to assess the effectiveness of these policies, but to investigate whether the political stability involving a frequent and durable interaction between purchaser and provider, results in a lower provision of C-sections.

Evidence of unverifiable quality in Health Economics has been confirmed by several papers (Kaarboe O., Siciliani L. 2011, A. Beitia 2003, Eggleston 2005, Dumont et al 2008, Newhouse (2002), Smith and York (2004))[4]. The assumption of altruism in this literature has been confirmed having a crucial effect on the providers performance. Althought, it seems that its application may not be completely suitable for all providers of health services, especially in case in which unverifiable and verifiable tasks coexist. Altruism clearly provides the incentive for the provider, once received the payment by the purchaser, to deliver unverifiable quality that directly enters its (and purchaser's) objective function. On the other hand, in a static scenario, this may mitigate the possible moral hazard arisen by the lack of external enforcement of unverifiable quality, with a clear cross implications for the verifiable component. With respect to the P4P scheme Olivella and Siciliani (2017) study how altruism affects the quality provision and find that whether quality is observable or not matters in terms of the provider's incentive. Siciliani (2009) and Makris and Siciliani (2013) focus on how altruism affects the quantity provision in a P4P scheme.[5] To the best of our knowledge none has still studied the characteristic of an optimal contract able to enforce unverifiable quality in health economics in a dynamic context and without altruism (MOTIVARE MEGLIO STORIA SU ASSENZA DI ALTRUISMO). We aim to contribute to this literature by introducing rela-

[4] Dumont et al (2008) provide empirical examples of unverifiable services in the Canadian health system.

[5] Example of altrusim are in Choné and Ma (2007), Ma (2007) and Jack (2005). Partially altruistic providers in model with aysmmetric informaion are Ellis and McGuire, 1986; Eggleston, 2005; Chalkley and Malcomson, 1998a). Literature with only surplus/profit maximisers provider is also large (see Ma, 1994; Chalkley and Malcomson, 1998b; Ellis, 1998). De Fraja, 2000; Beitia, 2003; Chalkley and Malcomson, 2002 .

tional contracting as incentive device to enforce unverifiable quality in Health Economics even when providers are not altruistic.

The paper has the following structure, section 2 formalizes the theoretical model, section 3 includes the empirical analysis. Section 4 concludes.

2 The Model

There are two active players, the purchaser of health services (the payer) and the provider (i.e. a hospital or a doctor)[6]. In the first stage the purchaser pays a price p for each unit of quality and a fixed transfer T, then in the second stage, once received the payment, the provider delivers the qualities of the health service, q_1 and q_2, where q_1 is verifiable (contractible) whereas q_2 is not. The purchaser cannot contract upon q_2 by specifying its level and the respective payment, p, in a complete contract.

The payoff functions are the following. Provider's utility:

$$U = T + pq_1 - \phi\left(q_1, q_2\right)$$

where $\phi\left(q_1, q_2\right)$ is the cost function. The Purchaser's utility is:

$$B\left(q_1, q_2\right) - T - pq_1$$

2.1 Static game

In this section we set up the static scenario (static game) that will be the constituent game we will use to set up a dynamic game obtained as an infinite repetition of the static one. The static game is composed by the following stages:

- **Stage 1**: purchaser provides reimbursement to the provider (p and T).[7]
- **Stage 2**: provider delivers the two qualities and patients receive the service (qualities) and profits are realized.

Proposition 1 *A Nash equilibrium strategy* (q_1^S, q_2^S, p^S) *of the static game entails: i)* $q_2^S = 0$, *ii)* q_1 *solving* $\frac{dB\left(q_1^S(p),0\right)}{dq_1} = \frac{d\phi\left(q_1^S,0\right)}{dq_1}$, *and iii)* $p^S = \frac{d\phi\left(q_1^S,0\right)}{dq_1}$.

As expected, in the static game the provider will deliver zero unverifiable quality because of its not contractible nature and deliver a level of verifiable quality by simply comparing marginal costs and marginal benefit (via the price p)

[6] The static part of our model is in line with the most recent literature, see for example Kaarboe and Siciliani (2011).

[7] AGGIUNGI ESEMPI SUL FUNZIONAMENTO DELLO SCHEMA CHE PONE IL RIMBORSO AL PRIMO STADIO

2.2 First best

We define the first-best solution in a setting where the purchaser maximizes welfare when both qualitites are observable and verifiable (then contractible via the payments). Since qualities are both verifiable, it is possible to set a specific price for each one. This is equivalent to set two different prices p_1 and p_2 for q_1 and q_2 respectively. More formally:

$$\max_{p_1,p_2} W = B\left(q_1\left(p\right), q_2\left(p\right)\right) - \phi\left(q_1\left(p\right), q_2\left(p\right)\right)$$

The First Best price and quality, defined by p_i^F and q_i^F, are then:[8]

$$p_1^F = \frac{dB\left(q_1^F, q_2^F\right)}{dq_1} \tag{1}$$

$$p_2^F = \frac{dB\left(q_1^F, q_2^F\right)}{dq_2} \tag{2}$$

$$\frac{dB\left(q_1^F, q_2^F\right)}{dq_1} = \frac{d\phi\left(q_1^F, q_2^F\right)}{dq_1} \tag{3}$$

$$\frac{dB\left(q_1^F, q_2^F\right)}{dq_2} = \frac{d\phi\left(q_1^F, q_2^F\right)}{dq_2} \tag{4}$$

By comparing the first best values with the static equilibrium we note that the conditions for the optimal price and the verifiable quality are not distorted but the level of unverifiable quality is not delivered at all with respect to the first best.

2.3 Relational contract

We set up a repeated game composed of an infinite repetition of the stage game of the previous section. Both players have the same discount factor given by δ. We define a P4P-RC by the levels q_1^*, q_2^*, T^*, p^*, where p^* is the price paid by the purchaser for each unit of q_1^*, q_2^*. Since q_2^* is not verifiable, the provider cannot write a contract with a specific p_2 and the only per unit price is p.[9] We assume that both purchaser and provider use trigger strategies s_{pu} and s_{pr} which are defined as it follows:

Purchaser (s_{pu}): Set T^* and p^* at time t if up to time $t-1$, the provider has chosen q_1^* and q_2^*; otherwise set p^P and T^P as in the Nash equilibrium (of the static game) for ever.

Provider (s_{pr}): Set q_1^* and q_2^* if up to the first period of time t the purchaser has set p^* and T^*; otherwise set q_1^P and q_2^P as in the Nash equilibrium (of the static game) for ever.

[8] We consider the interior solution.

[9] The same argument is applied Kaarboe and Siciliani 2011 although in a stratic P4P contract.

Note that p^P,T^P,q_1^P and q_2^P denote the punishment path the two players agree to play when off the cooperative path (occurring for instance when at least one of them deviates from what prescribed in the cooperative path entailed in s_{pu} and s_{pr}).

This game has clearly multiple equilibria. Let's the P4P-Relational Contract, in line with Levin (2003), be defined by the sub-game (perfect) equilibrium values q_1^*, q_2^*, T^*, p^* obtained as solution of the following Purchaser's maximization problem:

$$\max_{p,q_1,q_2} V = \frac{1}{1-\delta}\left(B\left(q_1,q_2\right)-T-pq_1-pq_2\right)$$

where V is the intertemporal utility of the purchaser along the "cooperative" path when both players stick to the strategy s_{pu} and s_{pr}, subject to the provider's incentive compatibility constraint (IC):

$$\frac{1}{1-\delta}\left(T+pq_1+pq_2-\phi\left(q_1,q_2\right)\right) \geq T+pq_1+pq_2-\phi\left(q_1,0\right)+\frac{\delta}{1-\delta}\left(T^P+p^P q_1^P\right) \tag{5}$$

The left hand side is the discounted purchaser's utility in the cooperative path, when none deviates from the cooperative levels q_1^*, q_2^*, T^*, p^*. Note that since the unverifiable quality is relational contractible it enters now the provider's utility. However, a cheating provider, once received the payment, can deviate on the unverifiable quality by delivering $q_2 = 0$, therefore the first part of the right hand side gives its net current incentive to deviate. Note that the best deviation for the provider is setting $q_2 = 0$ because, without altruism, the only value for the provider from the unverifiable quality is the value of future cooperation with the purchaser.[10] The provider cannot deviate on q_1 because of its verifiable nature, in other words, since q_1 is verifiable and contractible it is always possible charging the provider in front of the court for cheating and let the court to apply a credible fine as standard enforcing device. Note that (5) can be rewritten as:

$$\delta \geq \frac{\phi\left(q_1,q_2\right)-\phi\left(q_1,0\right)}{T+pq_1+pq_2-\phi\left(q_1,0\right)-\left(T^P+p^P q_1^P\right)} \tag{6}$$

As standard in relation contracting (6) gives the lowest discount factor such that the two players stick to their own cooperative strategy by enforcing the P4P-RC as sugbame equilibrium of the game. A similar IC should be added to ensure that also the purchaser does not deviate from the cooperative levels T^*, p^*, however due to the sequentially of the actions, this IC always holds because if the purchaser deviated at the first stage of the game it would be punished immediately by the provider in the same period of the game, without getting any current gain from deviating. If instead the provider and the purchaser played

[10] Formally it is equivalent to add the definition of the unverifiable deviation quality as denoted by $q_2^D = 0$. To ease the presentation we directly use 0 as deviation quality.

their actions simultaneously then the P4P-RC should need to satisfy both ICs, one for each player.

The following proposition defines the P4P-RC:

Proposition 2 *Let:*

$$\overline{\delta} = \frac{\phi\left(q_1^*, q_2^*\right) - \phi\left(q_1^*, 0\right)}{T^* + p^* q_1^* + p q_2^* - \phi\left(q*_1, 0\right) - \left(T^P + p^P q_1^P\right)} \tag{7}$$

The self enforcing P4P-RC is defined by $\delta \geq \overline{\delta}$ *and the values* q_1^*, q_2^*, T^*, p^* *satisfying:*

$$\frac{dB\left(q_1^*, q_2^*\right)}{dq_1} = \frac{d\phi\left(q_1^*, q_2^*\right)}{dq_1}\frac{1}{\delta} - \frac{d\phi\left(q_1^*, 0\right)}{dq_1}\frac{1-\delta}{\delta} \tag{8}$$

$$\frac{dB\left(q_1^*, q_2^*\right)}{dq_2} = \frac{d\phi\left(q_1^*, q_2^*\right)}{dq_2}\frac{1}{\delta} \tag{9}$$

$$p = \frac{dB\left(q_1^*, q_2^*\right)}{dq_2} \tag{10}$$

It is easy to note that when $\delta \to 1$ the two levels of qualities satisfy the first best. Also, note that the RHS of (9) is higher than the RHS of (4) (remind that $\delta < 1$). Since $B\left(q_1, q_2\right)$ is increasing in q_2, the P4P-RP induces a level of unverifiable quality higher than the FB. With respect to the level of the verifiable quality the result depends on the complementarity/substitutability between qualities. The RHS of (8) in fact is higher than the RHS of (3), then a P4P-RC induces more quality (less quality), if $\frac{d\phi(q_1,q_2)}{dq_1} > \frac{d\phi(q_1,0)}{dq_1}$ ($\frac{d\phi(q_1,q_2)}{dq_1} < \frac{d\phi(q_1,0)}{dq_1}$), with this result holding when $\frac{d\phi(q_1,q_2)}{dq_1 dq_2} > 0$ that implies that qualities are substitutes (complements if $\frac{d\phi(q_1,q_2)}{dq_1 dq_2} < 0$); therefore the P4P-RC induces an over-provision (lower-provision) of verifiable quality according to the technical relations between verifiable and unverifiable quality. Note that this result holds for any discount factor of the provider. It is interesting to note that when there is no technical relation between qualities, that is $\frac{d\phi(q_1,q_2)}{dq_1} = \frac{d\phi(q_1,0)}{dq_1}$, the P4P-RC induces no distortion for the verifiable quality from the FB.[11] Furthermore, note that the price is never distorted with respect to the FB, and is equal to the marginal benefit of the unverifiable quality.

In terms of policy implication look at the role of the high discount factor in the enforcing of the P4P-RC. A sufficiently high discount factor measures (as common in repeated games) the frequency of interactions in which players meet and update their actions (here price and qualities). Frequency can be interpreted as a proxy for the contractual length of the P4P-RC, in particular a high frequency of interaction can be a proxy for short contractual relationships

[11] Note that in Cesi et al. 2012, the regulator enforces unverifiable quality in a price cap model by inducing a distortion only on the verifiable varibles (price and verifiable quality) whereas the unverifiable quality induced by a relational contract induces no distortion with respect to the Rasmey qyality-adjusted condition.

among providers and purchaser. A high discount factor is also a measure for the stability of their interaction. In our model we have only one provider without free entry, clearly in terms of our jargon, this means that there is no risk of bankruptcy neither for the provider nor for the purchaser or, in other words, that a provider cannot be excluded by the market by a new entry with a new product.

3 Empirical analysis

3.1 Institutional background

The Italian healthcare system is a National Health Service regionally based. The service is funded by general taxation. The main principles of the system as well as the core basic package of services to be evenly provided across the national territory are defined by the central government. Within this framework, regions are autonomous in defining the organization of care; moreover, being responsible for the actual provision of services, they contract volumes with public autonomous and private hospitals. Services provided on behalf of the National Health Service are reimbursed by the region to autonomous public and private accredited hospitals according to DRG tariffs. The central government defines the national tariffs to be meant as the maximum amount of money that the National Health Service is willing to pay for that particular service. However, regions can modify national tariffs for several reasons, such as incentivize the use of a specific technology providing a higher rate, or hinder the provision of a certain service by decreasing the reimbursement rate relative to its best alternative.

3.2 Empirical strategy

We explore the effect of repeated interactions between regional authorities and hospital managers on the C-section rates. In order to proxy the durability of the interaction between these two players, we look at the number of years spent by regional authorities by covering their role. More in detail, we look at the regional governor and at the regional ministry of health.

We adopt a simple OLS approach. Our unit of observations are regions from 1996 to 2016. Our dependent variable is the share of C-sections on the overall number of deliveries in one year. The main independent variable is $tenure_{i,t}$ which is the time, measured in years, spent by the regional governor covering that position. This variable equals 0 in the year of the election, 1 in the next year and so on, and allows to track the cases when the same person covers more than one mandate. Eq. 1 describes the model:

$$sharecesarean_{i,t} = c+\beta_1 tenure_{i,t}+\gamma X_{i,t}+\alpha_1 \sum region_i+\alpha_t \sum year_t+\alpha_{j,t} \sum legislation_j * year_t+\varepsilon_{i,t} \tag{11}$$

The vector $X_{i,t}$ includes a set of control variables describing, for each region, the general health state of women, the socio economic status, the supply structure and the prices' regulation. More in detail, as measures of women's health state we consider the mean age at childbirth, the fertility rate, the percentage of obese women, the percentage of overweight women, the percentage of smokers. In order to keep the socioeconomic status in account, we also control for the number of residence permits, the number of foreigners residing in Italy, the employment rate, the female unemployment rate and the percentage of women with at least middle school degree. Moreover, we control for a few variables describing the development of DRG tariffs in each region: whether or not the region has its own set of tariffs, whether an update of tariffs occurred in the year and whether the region differentiates tariffs according to the type of hospital. Lastly, we included the rate between public and private health care personnel to account for the presence of private providers in the regional market.

All the models include region and year fixed effects. All models, except Model 1 include a legislation*region interaction terms to consider how the general principles pursued by the elected government can shape the health policy until the next elections, regardless of the tenure of the ministries. The same analysis has been run by using the tenure of the regional ministry of health as a dependent variable.

3.3 Data

We merge data from different sources. Data on health outcomes, supply and patients' satisfaction comes from "Health for All" OECD database. Data on regional governors and regional ministry of health come from the Ministry of Interior database. Data on DRG tariffs come from the reports published periodically by the Italian federation of companies producing medical devices (Assobiomedica) and have been double-checked by manual screening of regional decrees.

3.4 Results

Table 1 summarizes the results obtained using the tenure of the regional governors as independent variable.

The coefficient for tenure is negative and significant, meaning that a repeated and durable interaction between the purchaser and the provider decreases the provision of a potentially inappropriate service, thus increasing the unobservable quality. In particular, for each additional year that the governor is in force the rate of C-sections decreases by almost 2 percentage points. Therefore, political stability seems to play a role in determining the level of quality provided within the health care sector. Probably, providers who expect to interact with the same purchaser in the next term are keener on behaving properly and building a positive reputation along time.

The other coefficients, even when non-significant, exhibit the expected sign. Fertility rate exhibits a negative and significant association with our dependent

Table 1. Results: C-section rates, effect of regional governor's tenure.

VARIABLES	(1) C-section rate	(2) C-section rate	(3) C-section rate	(4) C-section rate	(5) C-section rate	(6) C-section rate
tenure	-0.0635	-2.0064***	-1.8921***	-1.8888***	-1.8772***	-1.8766***
	(0.050)	(0.584)	(0.582)	(0.604)	(0.614)	(0.616)
magedelivery			-0.5094	0.0425	0.1572	0.1968
			(1.511)	(1.661)	(1.668)	(1.697)
fertility rate			-0.0105**	-0.0116**	-0.0122**	-0.0121**
			(0.005)	(0.005)	(0.005)	(0.005)
obese women (%)			-0.0836	-0.0745	-0.0476	-0.0464
			(0.103)	(0.106)	(0.108)	(0.109)
overweight women (%)			-0.0195	-0.0463	-0.0670	-0.0670
			(0.073)	(0.077)	(0.079)	(0.079)
smokers (%)				-0.0050	-0.0015	0.0004
				(0.084)	(0.084)	(0.085)
female unemployment rate				0.0065	0.0200	0.0205
				(0.101)	(0.102)	(0.102)
residence permits				0.0000	0.0000	0.0000
				(0.000)	(0.000)	(0.000)
employment rate				-0.1063	-0.1379	-0.1432
				(0.238)	(0.240)	(0.244)
middle school diploma				0.0727	0.0939	0.0955
				(0.134)	(0.137)	(0.138)
foreigns resident				-0.0000	-0.0000	-0.0000
				(0.000)	(0.000)	(0.000)
differentiated tariffs					-0.5258	-0.5101
					(0.864)	(0.874)
regional DRGs					-0.1620	-0.1719
					(0.605)	(0.611)
tariffs update					-0.3325	-0.3383
					(0.250)	(0.254)
public/private personnel rate						-0.0012
						(0.008)
Constant	25.8907***	36.9368***	65.4115	50.5221	48.2813	47.3973
	(0.673)	(3.102)	(49.128)	(55.549)	(55.766)	(56.334)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
legislation*region		Yes	Yes	Yes	Yes	Yes
Observations	198	198	198	198	198	198
R-squared	0.97	0.99	0.99	0.99	0.99	0.99

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

variable, probably because of its negative relation with the mean age at delivery. Poorer socio economic status and lower education level tend to be positively related with C-section rates, supporting the idea that women in worse socioeconomic condition are more exposed to supply induced demand. Moreover, a closer attention of regional decision makers to DRG tariffs might play a role in improving the quality of services. Finally, the greater is the ratio between public and private personnel in a region, the smaller is the C-section rate.

Table 2 reports the results of similar analyses where the tenure of the regional ministry of health is the independent variable.

The results obtained in this set of models do not show any significant association between the tenure of the regional ministry of health and the C-section rate. This probably happens because within our sample a long tenure for the ministry of health is hard to be observed: while the mean tenure for the regional governor is 4.1 years, the mean tenure for regional ministries of health is 2.52 years. Indeed, it happens very frequently that during the same legislation even if the regional governor remains in force until the end of his mandate the ministry of health changes. Moreover, even in those (and quite frequent) cases when the regional governor is elected again after the first mandate; the council of ministries is very likely to change.

4 Discussion and conclusions

In this paper we explore the effect of repeated interactions between purchaser and provider of ealth services on the provision of unverifiable quality. We formalize their interaction by a relational contract and, by using Italian data on Cesarean sections, we empirically explore how the incentive power of such an agreement depends on the political stability, that in our jargon, is given by a frequent and durable interaction among provider and purchaser. In particular, we test whether relational contracting is associated to a lower provision of potentially inappropriate services. Through a standard OLS approach and controlling for health, socioeconomic, supply and contractual factors, we find that the C-section rates are lower in contexts where regional governments are more stable. The tenure of the regional governor is negatively related with the C-section rate, meaning that a more frequent interaction and a more durable relation between these two players improves the provision of unobservable quality. However, we do not find the same results when using the tenure of the regional ministry of health as an independent variable. Nonetheless, this result does not necessarily contradict our hypothesis. Even when the tenure of the regional governor is very long, the ministry of health can change since they stay in charge for an average of 2.52 years. However, even when the ministry of health resigns in the middle of a legislation, his successor is usually a person of the same political party, pursuing the same policies. Finally, it should be considered that the management of health care in Italian regions has represented a major policy concern in the last 20 years and regional governors have often played a central role in the design of health policies especially in regions experiencing recovery

Table 2. Results: C-section rates, effect of regional governor's tenure.

VARIABLES	(1) C-section rate	(2) C-section rate	(3) C-section rate	(4) C-section rate	(5) C-section rate	(6) C-section rate
tenuremoh	0.0013	0.1434	0.1496	0.1534	0.1499	0.1497
	(0.059)	(0.107)	(0.106)	(0.108)	(0.109)	(0.109)
magedelivery			-0.1220	0.5241	0.6290	0.6699
			(1.559)	(1.711)	(1.717)	(1.747)
fertility rate			-0.0112**	-0.0116**	-0.0122**	-0.0121**
			(0.005)	(0.005)	(0.005)	(0.005)
obese women (%)			-0.0805	-0.0637	-0.0400	-0.0387
			(0.107)	(0.110)	(0.112)	(0.112)
overweight women (%)			-0.0320	-0.0563	-0.0809	-0.0809
			(0.075)	(0.079)	(0.081)	(0.081)
smokers (%)				0.0039	0.0086	0.0105
				(0.086)	(0.087)	(0.088)
female unemployment rate				-0.0556	-0.0433	-0.0428
				(0.102)	(0.103)	(0.103)
residence permits				0.0000	0.0000	0.0000
				(0.000)	(0.000)	(0.000)
employment rate				-0.0752	-0.1090	-0.1146
				(0.246)	(0.248)	(0.252)
middle school diploma				0.0997	0.1089	0.1106
				(0.138)	(0.142)	(0.143)
foreigns resident				0.0000	0.0000	0.0000
				(0.000)	(0.000)	(0.000)
differentiated tariffs					-0.8958	-0.8793
					(0.882)	(0.893)
regional DRGs					-0.1527	-0.1630
					(0.624)	(0.631)
tariffs update					-0.2798	-0.2858
					(0.258)	(0.262)
public/private personnel rate						-0.0013
						(0.009)
Constant	25.8695***	26.1305***	44.4038	23.0716	22.1783	21.2728
	(0.676)	(1.003)	(50.423)	(56.932)	(57.157)	(57.735)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
legislation*region		Yes	Yes	Yes	Yes	Yes
Observations	198	198	198	198	198	198
R-squared	0.97	0.99	0.99	0.99	0.99	0.99

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

plans.

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[6] ....to be continued

5 Appendix

Proof of Proposition 1

Proof. The proof is straightforward. The model is solved by backwards induction, starting with the provider's choice of quality levels. At the last stage the provider finds no direct benefit from the delivery of unverifiable quality and delivers an (uncontractible) level of quality equal to zero. In particular, the solution of the static game is: **stage 2**: For a given p, the provider optimally sets q_2^S and q_1^S as defined below:

$$q_2 = 0 \tag{12}$$

$$p = \frac{d\phi\left(q_1, q_2\right)}{dq_1} \tag{13}$$

Stage 1: Purchaser's:

$$\max_p B\left(q_1, q_2\right) - T - pq_1$$

$$\begin{aligned} &\text{s.t.} \\ U &\geq 0 \\ &\text{or} \\ T + pq_1 &\geq \phi\left(q_1, q_2\right) \end{aligned}$$

when the constraint is binding we have:

$$\max_p B\left(q_1\left(p\right), q_2\left(p\right)\right) - \phi\left(q_1\left(p\right), q_2\left(p\right)\right)$$

under the constraints from the provider's maximization problem (12) and (13):

$$q_2 = 0$$

$$p - \frac{d\phi\left(q_1, 0\right)}{dq_1} = 0; q_1 > 0 \tag{14}$$

we obtain:

$$\frac{dB\left(q_1^S\left(p\right), 0\right)}{dq_1}\frac{dq_1}{dp} - \frac{d\phi\left(q_1^S\left(p\right), 0\right)}{dq_1}\frac{dq_1}{dp} = 0$$

$$\frac{dq_1}{dp}\left(\frac{dB\left(q_1^S\left(p\right), 0\right)}{dq_1} - \frac{d\phi\left(q_1^S\left(p\right), 0\right)}{dq_1}\right) = 0$$

and by using (14):

$$p^S = \frac{dB\left(q_1^S\left(p\right), 0\right)}{dq_1}$$

see that the optimal price is set equal to the marginal benefit of the verifiable quality 1 and the marginal cost of quality (the price) is set equal to marginal benefit of quality. Quality is then given by:

$$\frac{dB\left(q_1^S\left(p\right), 0\right)}{dq_1} = \frac{d\phi\left(q_1^S, 0\right)}{dq_1}$$

The solution of T is given by the binding constraint. ■

Proof of the First Best

Proof. We solve the maximization of W subject to the optimal quality set by the provider at the second stage in (15) and (16):

$$p_1 = \frac{d\phi\left(q_1, q_2\right)}{dq_1} \tag{15}$$

$$p_2 = \frac{d\phi\left(q_1, q_2\right)}{dq_2} \tag{16}$$

$$\frac{dW}{dp_1} = \frac{dB}{dq_1}\frac{dq_1}{dp_1} - \frac{d\phi\left(q_1, q_2\right)}{dq_1}\frac{dq_1}{dp_1}$$

$$\frac{dW}{dp_2} = \frac{dB}{dq_2}\frac{dq_2}{dp_2} - \frac{d\phi\left(q_1, q_2\right)}{dq_2}\frac{dq_2}{dp_2}$$

by using (15) and (16) we have:

$$\frac{dW}{dp_1} = \frac{dq_1}{dp_1}\left(\frac{dB}{dq_1} - p_1\right)$$

$$\frac{dW}{dp_2} = \frac{dq_2}{dp_2}\left(\frac{dB}{dq_2} - p_2\right)$$

then the first best prices are:

$$p_1^F = \frac{dB\left(q_1^F, q_2^F\right)}{dq_1}$$

$$p_2^F = \frac{dB\left(q_1^F, q_2^F\right)}{dq_2}$$

and after substituting above we have the first best quality. ■

Proof of Proposition 2

Proof. Consider the following maximization problem[12]:

$$L = \frac{1}{1-\delta}\left(B\left(q_1, q_2\right) - T - pq_1 - pq_2\right) + \lambda\left(\delta - \frac{\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)}{T + pq_1 + pq_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)}\right)$$

$$\frac{dV}{dq_1} = \frac{1}{1-\delta}\left(\frac{dB\left(q_1, q_2\right)}{dq_1} - p\right) - \tag{17}$$

$$-\lambda\left(\frac{\left(\frac{d\phi(q_1,q_2)}{dq_1} - \frac{d\phi(q_1,0)}{dq_1}\right)\left(T + pq_1 + pq_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right) - \left(p - \frac{d\phi(q_1,0)}{dq_1}\right)\left(\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)\right)}{\left(T + pq_1 + pq_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)^2}\right)$$

$$q_1 \geq 0, \frac{dV}{dq_1} q_1 = 0$$

$$\frac{dV}{dq_2} = \frac{1}{1-\delta}\left(\frac{dB\left(q_1, q_2\right)}{dq_2} - p\right) - \tag{18}$$

$$-\lambda\left(\frac{\frac{d\phi(q_1,q_2)}{dq_2}\left(T + pq_1 + pq_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right) - p\left(\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)\right)}{\left(T + pq_1 + pq_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)^2}\right) \leq 0,$$

$$q_2 \geq 0, \frac{dV}{dq_2} q_2 = 0$$

$$\frac{dV}{dp} = -\frac{1}{1-\delta} + \lambda\frac{\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)}{\left(T + pq_1 + pq_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)^2} \leq 0, p \geq 0, \frac{dV}{dp} p = 0 \tag{19}$$

$$\frac{dV}{d\lambda} = \delta - \frac{\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)}{T + pq_1 + pq_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)} \geq 0, \quad \lambda \geq 0; \quad \lambda L_\lambda = 0$$

Consider that a case $q_1 = 0$ induces $\frac{dV}{dq_1} < 0$, that clearly contradicts our assumption on the utility. The same holds for q_2. From (17)(18)(19), it follows that $\lambda > 0$, if this were not the case, we would have that $\frac{dV}{dp} = \frac{dV}{dq_1} = \frac{dV}{dq_2} = 0$, which clearly contradicts our hypothesis that the first best is out of reach. Therefore $\frac{dV}{d\lambda} = 0$ gives (7). Consider the interior solution, by dividing (18) and (20) we obtain:

[12] we rule out the index $*$ to ease the proof.

$$\frac{\frac{dB(q_1,q_2)}{dq_2}-p}{\frac{dB(q_1,q_2)}{dq_1}-p}=\frac{\frac{d\phi(q_1,q_2)}{dq_2}\left(T+pq_1+pq_2-\phi(q_1,0)-\left(T^P+p^Pq_1^P\right)\right)-p\left(\phi(q_1,q_2)-\phi(q_1,0)\right)}{\left(\frac{d\phi(q_1,q_2)}{dq_1}-\frac{d\phi(q_1,0)}{dq_1}\right)\left(T+pq_1+pq_2-\phi(q_1,0)-\left(T^P+p^Pq_1^P\right)\right)-\left(p-\frac{d\phi(q_1,0)}{dq_1}\right)\left(\phi(q_1,q_2)-\phi\right.} \tag{20}$$

and by dividing (19) and (17)

$$\frac{1}{\frac{dB(q_1,q_2)}{dq_1}-p}=\frac{\phi(q_1,q_2)-\phi(q_1,0)}{\left(\frac{d\phi(q_1,q_2)}{dq_1}-\frac{d\phi(q_1,0)}{dq_1}\right)\left(T+pq_1+pq_2-\left(T^P+p^Pq_1^P\right)\right)-\left(p-\frac{d\phi(q_1,0)}{dq_1}\right)\left(\phi(q_1,q_2)-\phi(q_1,0)\right)} \tag{21}$$

By substituing the value of $\frac{dB(q_1,q_2)}{dq_1}-p$ obtained from (21) into the the FOC (17) and we obtain:

$$\lambda=\frac{1}{1-\delta}\frac{\left(T+pq_1+pq_2-\phi(q_1,0)-\left(T^P+p^Pq_1^P\right)\right)^2}{\phi(q_1,q_2)-\phi(q_1,0)} \tag{22}$$

Substituing the value of δ obtained from the binding condition $\frac{dV}{d\lambda}=0$ into (22) we finally obtain:

$$\lambda=\frac{1}{\delta^2(1-\delta)}\left[\phi(q_1,q_2)-\phi(q_1,0)\right] \tag{23}$$

Now by substitung (23) into (21) we obtain the condition for the verifiable quality, that is:

$$\frac{dB(q_1,q_2)}{dq_1}=\frac{d\phi(q_1,q_2)}{dq_1}\frac{1}{\delta}-\frac{d\phi(q_1,0)}{dq_1}\frac{1-\delta}{\delta} \tag{24}$$

Substituting (24) into (20) and using the value of δ from $\frac{dV}{d\lambda}=0$, we find the condition for the unverifiable quality:

$$\frac{dB(q_1,q_2)}{dq_2}=\frac{d\phi(q_1,q_2)}{dq_2}\frac{1}{\delta} \tag{25}$$

Note that by dividing (19) and (18) we also obtain:[13]

$$\frac{1}{\frac{dB(q_1,q_2)}{dq_2}-p}=\frac{\frac{\phi(q_1,q_2)-\phi(q_1,0)}{\left(T+pq_1+pq_2-\phi(q_1,0)-\left(T^P+p^Pq_1^P\right)\right)^2}}{\frac{d\phi(q_1,q_2)}{dq_2}\left(T+pq_1+pq_2-\phi(q_1,0)-\left(T^P+p^Pq_1^P\right)\right)-p\left(\phi(q_1,q_2)-\phi(q_1,0)\right)} \tag{26}$$

and, after some algebra, (26) gives:

$$p=\frac{\delta^2}{\delta^2-\left[\phi(q_1,q_2)-\phi(q_1,0)\right]^2}\left(\frac{dB(q_1,q_2)}{dq_2}-\frac{d\phi(q_1,q_2)}{dq_2}\frac{\left[\phi(q_1,q_2)-\phi(q_1,0)\right]^2}{\delta^3}\right)$$

[13] se divide FOC3 e FOC 1 riottengo (3) dunque non ottengo il prezzo

that, by using (25), gives:

$$p = \frac{dB\left(q_1, q_2\right)}{dq_2}$$

Consider now the case $p_1 \neq p_2$.

$$L = \frac{1}{1-\delta}\left(B\left(q_1, q_2\right) - T - p_1 q_1 - p_2 q_2\right) + \lambda\left(\delta - \frac{\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)}{T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)}\right)$$

the new (17) and (18) are simply given by the price multiplyng q_1 and q_2 by $p = p_1$ and $p = p_2$. Same argument hold for $\frac{dV}{d\lambda} = 0$.

$$\frac{dV}{dq_1} = \frac{1}{1-\delta}\left(\frac{dB\left(q_1, q_2\right)}{dq_1} - p_1\right) - \lambda\left(\frac{\left(\frac{d\phi(q_1,q_2)}{dq_1} - \frac{d\phi(q_1,0)}{dq_1}\right)\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right) - \left(p_1\right.}{\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right.\right.}\right. \tag{27}$$

$$\frac{dV}{dq_2} = \frac{1}{1-\delta}\left(\frac{dB\left(q_1, q_2\right)}{dq_2} - p_2\right) - \lambda\left(\frac{\frac{d\phi(q_1,q_2)}{dq_2}\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right) - p_2\left(\phi\left(q_1, q_2\right) - \phi\right.}{\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)^2}\right. \tag{28}$$

The new Focs wrt to p_1 and p_2 are now:

$$-\frac{q_1}{1-\delta} + \lambda\left(\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)\right)\frac{q_1}{\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)^2} = 0 \tag{29}$$

$$-\frac{q_2}{1-\delta} + \lambda\left(\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)\right)\frac{q_2}{\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)^2} = 0 \tag{30}$$

from the (29) we obtain:

$$\lambda = \frac{1}{1-\delta}\frac{\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)^2}{\left(\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)\right)} = \frac{1}{\delta^2\left(1-\delta\right)}\left[\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)\right] \tag{31}$$

by substituting (31) into the (27) and after algebra we obtain q_1

$$\frac{dB\left(q_1, q_2\right)}{dq_1} = \frac{\left(\frac{d\phi(q_1,q_2)}{dq_1} - \frac{d\phi(q_1,0)}{dq_1}\right)\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)\right)}{\left(\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)\right)} + \frac{d\phi\left(q_1, 0\right)}{dq_1} \tag{32}$$

$$\frac{dB\left(q_1, q_2\right)}{dq_1} = \frac{d\phi\left(q_1, q_2\right)}{dq_1}\frac{T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \left(T^P + p^P q_1^P\right)}{\phi\left(q_1, q_2\right) - \phi\left(q_1, 0\right)} - \frac{d\phi\left(q_1, 0\right)}{dq_1}\left(\frac{\left(T + p_1 q_1 + p_2 q_2 - \phi\left(q_1, 0\right) - \right.}{\left(\phi\left(q_1\right.\right.}\right.$$

by doing the same procedure by sustituting (31) into the (28) we obtain q_2:

$$\frac{dB\left(q_1,q_2\right)}{dq_2}=\frac{d\phi\left(q_1,q_2\right)}{dq_2}\frac{\left(T+p_1q_1+p_2q_2-\phi\left(q_1,0\right)-\left(T^P+p^Pq_1^P\right)\right)}{\left(\phi\left(q_1,q_2\right)-\phi\left(q_1,0\right)\right)} \tag{33}$$

from $\delta=\frac{\phi(q_1,q_2)-\phi(q_1,0)}{T+pq_1+pq_2-\phi(q_1,0)-\left(T^P+p^Pq_1^P\right)}$, we can rewrite 32 and 33 as it follows:

$$\frac{dB\left(q_1,q_2\right)}{dq_1}=\frac{d\phi\left(q_1,q_2\right)}{dq_1}\frac{1}{\delta}-\frac{d\phi\left(q_1,0\right)}{dq_1}\left(\frac{1-\delta}{\delta}\right)$$

$$\frac{dB\left(q_1,q_2\right)}{dq_2}=\frac{d\phi\left(q_1,q_2\right)}{dq_2}\frac{1}{\delta}$$

It is possible to note that the optimal conditions for prices as seeb above still hold:

$$p_1=\frac{dB\left(q_1,q_2\right)}{dq_1}$$

$$p_2=\frac{dB\left(q_1,q_2\right)}{dq_2}$$

■