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Political Electoral Cycles and Evolution of Italian Health Care System Financing. A Long Run Perspective

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ABSTRACT

Embracing the political-electoral cycles approach (Alesina and Roubini 2004; Besley 2007; Rogoff 1990), the aim of the paper is the explanation of the instability of the financing rules in the Italian Health Care System.

In the first part of the contribution, we will demonstrate that during electoral periods:

1. Regional Government raises the health care debt.
2. National Government reduces health care transfers to Regions.
3. National Government bails out the debt of Regions

In the second part of the contribution, an empirical analysis of the theoretical results is presented. The most important conclusion is that the regional elections can explain the health care system's incentive to bail out (the estimations are computed for the 15 Italian Regions with ordinary statute, in the period 1982-2009).

Our results are of course specific to the Italian institutional framework, but they suggest an important political principle: only a better division of the responsibilities about the Health Care System's financing between Central Government and Regions can reduce the instability that political-electoral cycles, in all probability, introduce.

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1. Introduction

A persistent feature of the Italian Health Care System (HCS) is the inconsistency between the dynamics of HCS spending and the dynamics of the HCS financing. The Italian HCS is characterized by a structural deficit and by the persistent bailing out of the Regional HCS (Ministry of Economy, various years; Fattore 1999; Anessi Pessina, Cantu and Jommi, 2001; Bordignon and Turati 2009)

Some scholars affirm that the story of the annual financing in the Italian health system confirms a distortive decision-making process by the policy makers: in the face of rising health care costs will have inadequate funding by the Central Government, together with financial irresponsibility of the Regions (Artoni 2003, p. 354-355; Reviglio 2001).

The analysis of the dynamics of the Italian HCS's financing focused on the sustainability of funding rules. Scholars studied the problem of the different objectives between the Central Government and the Regions (Bordignon, Mapelli and Turati, 2002, Bordignon and Turati 2003, 2005, 2009). These contributions focused:

1) on the Government's budget dressing;

2) the tendency to re-balance the *ex-ante* transfers by means of ex-post transfers and on the basis of actual expenditure;

3) the Central Government's inability in the estimation of the necessary Regional spending, depending both on the specific Regional structure of the production of services and on the needs of the population;

4) on the structural characteristics of bailing out Regional deficits.

Empirical tests use data that do not precede the year 1990.

Our first aim is to provide an original and attentive explanation of the instability of the rules relating to the financing of the Italian HCS through a theoretical model of electoral policy cycle (Persson and Tabellini 2000, Alesina and Roubini 2004).

It is true that the tendency to create deficits characterizes the evolution of the health system in Italy, but it is also true that the regional electoral cycles increase this trend.

A deeper research towards these directions may be very important for designing policy interventions, and to support an important political principle: only a better division of the responsibilities about the Health Care System's financing between Central Government and Regions can reduce the instability that political-electoral cycles introduce.

2. The Model

We will describe the provision of HCS as a game among citizens, regional incumbent politician and National Central Government.

Citizens and governments play a game where citizens decide to re-elect regional incumbents on the basis of health care provision, for simplicity we only focus on regional election and not consider national one.

Regional and National Governments play a game where Central Government decides the amount of taxes on citizens and finances both health care and debt with taxes, while Regions (that we consider as an unique player) provide health care. Thus health care is financed by a national transfer from Central Government to Region (we assume that different Regions behave as a single agent). Regional Government could decide to run a debt and to provide excess health care on respect to transfer.

Both Regional and Central Government are quasi-benevolent, thus they have the same

utility function of citizens; the only different is that governments in charge enjoy an ego-rent, which is constant. As we will show below, the ego-rent is crucial in election times.

We assume a separable utility function for citizen *i* as follows:

$$W^i(C, H) = c(C) + h(H - L(\lambda, \theta) + X^i;\ c_C > 0;\ h_H > 0;\ L_\theta > 0;\ c_{CC} < 0;\ h_{HH} < 0;\ L_{\lambda\lambda} > 0;\ L_{\lambda\theta} > 0 \quad (1)$$

where C is private consumption, H is health care provision, λ is the health deficit or the share of health expenditure financed by new debt, θ is the toughness of formal and informal fiscal rules against debt.

Note that when Region runs debt, utility decreases; in effect function $L(\lambda, \theta)$ represents the perceived costs for citizens of running a debt, such costs depend on the fact that citizens know that when Region runs debt, soon or later they will pay for it in term of lower provision of health care, higher taxes and so on. Such a cost increases when the fiscal rules are tough, such rules could be both formal (i.e. internal stability pact) or informal (blame against debt). Since the actual costs that citizens perceived depends on both legal, psychological and cultural factors, we prefer not to model it as a discounting of future expenses due to debt payment, but to leave it implicit.

$X^i > 0$ is the ego-rent of individual *i* when he is the politician in charge, when individual *i* is not in charge $X^i = 0$.

Private consumption is defined as:

$$C = Y - tY - bY \quad (2)$$

where Y is citizens' income (GDP), t is the normal tax rate set by National Government in order to pay health care, due to our assumption[1] it represents also the rate of transfers to Region in order to pay health care;

b is the surcharge tax rate that Central Government sets in order to pay debt. Note that in this simplified model the only way to bail out the debt of the Region is to raise taxes on citizens and to use tax revenue to pay debt. Thus b represents the bailing out rate.

Health care provision is defined as

$$H = \frac{(\lambda + 1)\, t\, Y}{p} \quad (3)$$

where p is the price of health care provision: such a price depends on general economic conditions (general price level), on the ability of regional incumbents to sign cheap contract with health care providers, thus it is an index of competency of politician, on exogenous factors. The actual price is known only by regional politician in charge (incumbent). Citizens and National Government know the distribution of prices and can infer the actual value from incumbent past behavior.

We assume that, in each period τ, the price for health care that a generic individual would pay is:

$$p^{i,\tau} = 1 + \eta^{i,\tau} + \eta^{i,\tau-1};\ E(\eta) = 0 \quad (4)$$

where both $\eta^{i,\tau}$, and the incumbent's $\eta^{I,\tau}$ are unknown; it means that the component of efficiency which depends on decision at time τ, is completely unknown. On the contrary, citizens and National Government know the value of $\eta^{I,\tau-1}$ for the incumbent, but not for

1 In order to keep the model simple, we assume that taxes are collected only by national government and health care is provided only by Regions. We can relax this assumption and consider that Regions could raise taxes, in this case t is the sum of national transfer and standard regional tax rate.

other individuals ($\eta^{i,\tau-1}$). They are able to evaluate the efficiency of the decision taken in the past period by incumbent.

Thus in each period, the expected value of price for a generic regional politician is $E(p)=1$, while the expected value for price paid by incumbent is $E(p^I)=1+.\ \eta^{I,\tau-1}$

We have two cases, the electoral period and the non-electoral period, that we will analyze in the following pages.

In a non-electoral period, Regional Government sets the provision of health care considering the true price it pays. A different provision of health care will be sub-optimal; since the Central Government knows this behavior it can infer the real value of price observing the health care provision. In this case $\hat{H}(p^I)=argmax\ W(C, H)$ and the actual value of price can be calculated from the value of health care provision $p^I = H^{-1}[W(\hat{C}, \hat{H})]$, since a different provision of health care $H\neq\hat{H}(p^I)$ implies that $W(C, H)<W(\hat{C}, \hat{H})$. Note that the expected value of price is the true value of price $E(p^I)=p^I$, thus the expected maximization problem collapse in a standard maximization problem with certainty $E(W[C(p^I), H(p^I)]/p^I)=maxW(\hat{C}(p^I), \hat{H}(p^I))$. Consequently citizens do not play any role.

In the electoral time, citizens have to express their vote, thus the incumbent politician, that represents the Regional Government, could lose his ego rent, if he is not re-elected. In this case, the incumbent could provide an higher amount of heath care, $\tilde{H} > \hat{H}$, in order to be re-elected. The incumbent will provide such higher amount, if he would like to signal his own efficiency, that is to say if the utility of remaining in charge is higher than the expected utility of electing another candidate:

$$W(\tilde{C},\tilde{H}) + X^i > \max E[W(\hat{C},\hat{H}) / p^I] \tag{5}$$

In this case citizens will re-elect incumbent if the expected utility of election of the incumbent is higher than the expected utility of electing an opponent

$$E[W(\tilde{C},\tilde{H}) / p] > \max E[W(\hat{C},\hat{H}) / p^I] \tag{6}$$

and, moreover, National Government will set taxes in order to maximize $E(W[\tilde{C}(p^I),\tilde{H}(p^I) / p^I)$.

In the following paragraphs, we will solve the model: first, we will consider the non-electoral time (§ 2.1), then , the electoral time (§ 2.2).

2.1 Solutions in a non-electoral time

When there are not election, citizens do not play any role in the decisions of health care provision. In this case, the game between state and region is a Cournot-Nash game under certainty.

Central Government has to maximize W, setting tax rate t and b, under a constraint on the ratio between debt and GDP, $\frac{D}{Y} = \frac{dD}{dY} \leq \gamma$. The deficit ratio set by Regions is considered as a constant. Regional Government maximizes W setting the health deficit ratio and considers the tax rate as a constant.

We may define the optimal reaction function of Central Government. In this case the maximization problem is:

$$\underset{t,b}{Max}\, W = c(Y - tY - bY) + h\left[(1+\lambda)\frac{tY}{p}\right] - l(\lambda,\theta)$$
$$s.t.\, b \le \lambda t - \Gamma;\ \Gamma = \gamma\left(\frac{dY}{Y} - i\right) \tag{7}$$

where $\frac{dY}{Y}$ is the GDP growth rate and i is the interest rate on debt. Since $W_b = \frac{dW}{db} < 0$, respecting the constraint implies that

$$b = min\ (0\ ;\ \lambda t - \Gamma) \tag{8}$$

substituting such constraint in equation 7, the optimal value of taxes, $\bar{t}$, solves this FOC

$$FOC1: W_t = \frac{dW}{dt} = -Y c_C\left(1 + \frac{db}{dt}\right) + (1+\lambda)\frac{Y}{p} h_H = 0 \tag{9}$$

where SOC holds $W_{tt} = Y^2 c_{CC}\left(1 + \frac{db}{dt}\right)^2 + (1+\lambda)^2 \frac{Y^2}{p^2} h_{HH} < 0$. Equation 9 is the condition which sets the marginal rate of substitution equal to price $\left(\frac{h_H}{c_C} = p\frac{1 + \frac{db}{dt}}{1+\lambda}\right)$, note that when the constraint is not binding, then $\frac{db}{dt} = 0$, when it is binding $\frac{db}{dt} = \lambda$, thus when constraint is not binding ($b=0$) financing health care with debt permit to reduce the actual cost that region pays.

Applying implicit function theorem it is possible to calculate the slope of reaction function of Central Government to regional decisions on deficit rate, $\bar{t} = \bar{t}(\lambda)$.
The next two propositions summarize the equilibria of the game.

Proposition 1: *The optimal tax rate* $\bar{t}$ *is decreasing on deficit rate* λ *when health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus an increase in deficit implies a waste of resource and reduces the incentive to transfer money to Regions.*

Proof: see Appendix.

We may consider this behavior as the reaction function of Central Government.

Proposition 2: *When the cost of health care p increases, the optimal tax rate* $\bar{t}$ *increases if health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus, when the demand for health care is rigid an increase in its cost implies that National Government will transfer more to Region in order to grant a good level of health care.*

Proof: see Appendix.

Now, we may define the optimal reaction function of Regional Government. In this case the maximization problem is:

$$\underset{\lambda}{Max}\, W = c(Y - tY - bY) + h\left[(1+\lambda)\frac{tY}{p}\right] - l(\lambda, \theta) \tag{10}$$

where b is constant for Regional Government[2]. Thus the optimal response of Region in setting deficit rate λ, when Central Government sets tax rates is the solution of the following FOC:

$$FOC2: W_{\lambda} = \frac{dW}{d\lambda} = \frac{tY}{p} h_H - l_{\lambda} = 0 \tag{11}$$

where SOC holds $W_{\lambda\lambda} = \frac{(tY)^2}{p^2} h_{HH} - l_{\lambda\lambda} < 0$. It is possible to calculate the slope of reaction function of Regional Government to national decisions on transfers, $\overline{\lambda} = \overline{\lambda}(t)$.

Proposition 3: *The optimal deficit rate λ is decreasing on transfer t when health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus an increase in transfer implies a lower necessity to run debt by Regions.*

Proof: see Appendix.

We may consider this behavior as the reaction function of Regional Government.

Proposition 4: *When the cost of health care p increases, the optimal deficit rate λ increases if health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus, when the demand for health care is rigid an increase in its cost implies that Regional Government will run bigger deficit in order to grant a good level of health care.*

Proof: see Appendix.

Proposition 5: *The optimal deficit rate decreases when the toughness of fiscal rules increases.*

Proof: see Appendix.

The ***Nash equilibrium*** $(\hat{t}, \hat{\lambda})$ can be calculated solving the system of the two FOCs (equation 9 and equation 11). Graphically[3] the equilibrium is depict in Figure 1, where N1 is the Nash equilibrium for $p_1$and N2 is the one for $p_2 > p_1$, because equation 8, $\hat{b}(p_2) \geq \hat{b}(p_1)$, with equal if the constraint on debt is not binding.

2 It is easy to demonstrate that when the constraint is binding if regional government considers the constraint, thus consider that $\frac{db}{d\lambda} = t$, it is optimal not to run debt λ=0.

3 Detail in the appendix.

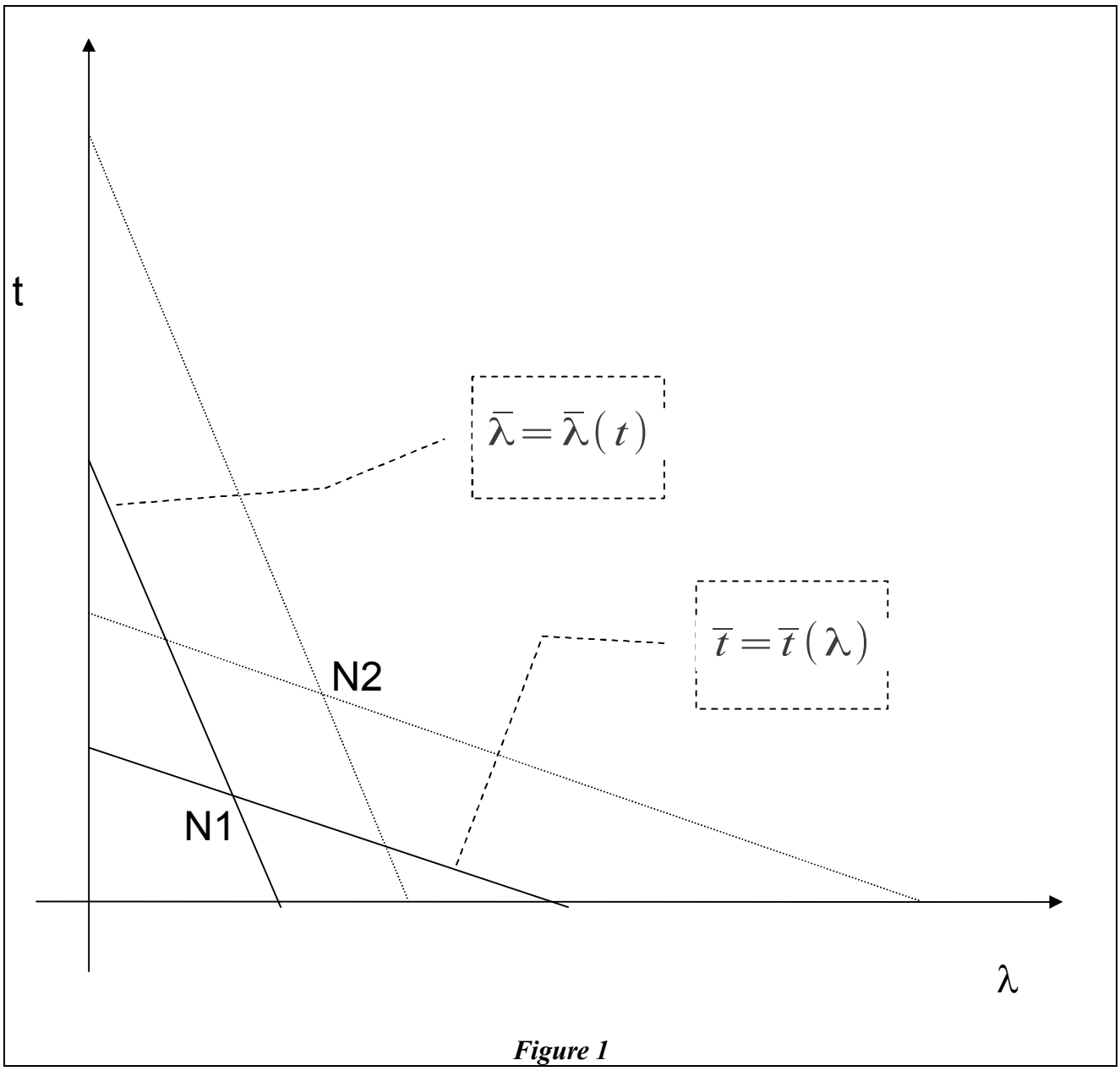


Figure 1

2.2 Solutions in the electoral period

In the electoral period, regional incumbent has interest to be re-elected and he could not give the true information in order to calculate the costs of health care. Citizens and National Government know the value $\eta^{I,\tau-1}$ of the incumbents, but they do not know the same value of the other candidate (opponent); moreover they do not know the value $\eta^{I,\tau}$ both for the incumbent and the opponent.

Let us assume that in each period η is distributed as a binomial: when individual is efficient, then $\eta=-\mu<0$; when individual is not efficient, then $\eta=\mu>0$; we assume that the probability to be efficient is 0.5. Three prices are possible: $p_1=1+2\mu$, with probability equal to 0.25; $p_2=1$, with probability equal to 0.5; finally, $p_3=1-2\mu$, with probability 0.25.

Note that the value of the maximum utility, and the value of optimal health care provision, are decreasing with price. Thus

$$\hat{H}(p_1)<\hat{H}(p_2)<\hat{H}(p_3)$$
$$max\,W(p_1)<max\,W(p_2)<max\,W(p_3)$$

If citizens elect an opponent, then the expected utility they gain is the mean of maximum utility

$$E(W)=0.25maxW(p_1)+0.5maxW(p_2)+0.25maxW(p_3) \qquad (12)$$

Note that, for a given price, all the other provisions of health care that are different from the optimal one, reduce utility.

Let us assume that $\eta^{I,\tau-1}=\mu>0$; it means that the past decisions and events were not efficient. The actual value of price paid by incumbent could be only $p_1=1+2\mu$ or $p_2=1$, each with probability of 0.5. Thus, on the average the incumbent will be able to provide an utility level $0.5W(p_1)+0.5W(p_2)\leq 0.5\ max\ W(p_1)+0.25\ max\ W(p_2)$, which is lower than $E(W)$. In this case citizens will always elect an opponent and the optimal strategy for incumbent is to declare the true level of prices. Thus the game between Central and Regional Governments does not change.

Let us assume that $\eta^{I,\tau-1}=-\mu<0$; in this case, the past decisions and events were efficient. The actual value of price paid by incumbent could be only $p_3=1-2\mu$ or $p_2=1$, each with probability of 0.5. If $max\ W(p_2)>E(W)$, then the incumbent does not have reason to provide a level of health care lower than the optimal level for $p_2=1$, since in any case it will be re-elected.

On the contrary, if $max\ W(p_2)<E(W)$, then citizens will not re-elect incumbent which declare $p_2=1$. Thus, in order to perceive the ego-rent, incumbent could provide $H(p_3)>H(p_2)$ running debt. In this case the utility of citizens will be $\hat{H}(p_3) > \hat{H}(p_2)$. Citizens could re-elect the incumbent only if $E(W)<0.5W(\hat{H}(p_3),\ p_2)+0.5\ max\ W(p_3)\leq 0.5\ max\ W(p_2)+0.5\ max\ W(p_3)$. Consequently, citizens will always elect an opponent and the optimal strategy for incumbent is to declare the true level of prices. Thus the game between Central and Regional Governments does not change.

The possibility that Region would provide a level of health care higher than the optimal one, changes the nature of the game between National and Regional Governments during the election period (actually in the year before election). The Regional Government would provide $H(p_3)$ even if the true price is $p_2=1$, thus he sets λ such that

$$(1+\tilde{\lambda})\frac{\check{t}\,Y}{p_2}=(1+\hat{\lambda})\frac{\hat{t}\,Y}{p_3}=\hat{H}(p_3) \qquad (13)$$

where we define $\breve{t}$ as the solution of the maximization problem for the Central Government. Thus we have: $\tilde{\lambda}=(1+\hat{\lambda})\frac{p_2}{p_3}\frac{\hat{t}}{\breve{t}}-1>\hat{\lambda}$

National government would maximize the expected value:

$$\max_{t} 0.5\{c[Y-\min(tY;tY(1+\hat{\lambda})-\Gamma Y)]\}+0.5\{c[Y-\min(tY;tY(1+\tilde{\lambda})-\Gamma Y)]\}+h[(1+\hat{\lambda})\frac{tY}{p_3}]-K \qquad (14)$$

Proposition 6: *During electoral periods Central Government reduces health care transfer to Region.*

Proof: see Appendix.

Proposition 7: *During electoral periods Central Government raises the tax rate for reducing the debt, thus he bails out the debt of Region.*

Proof: see Appendix.

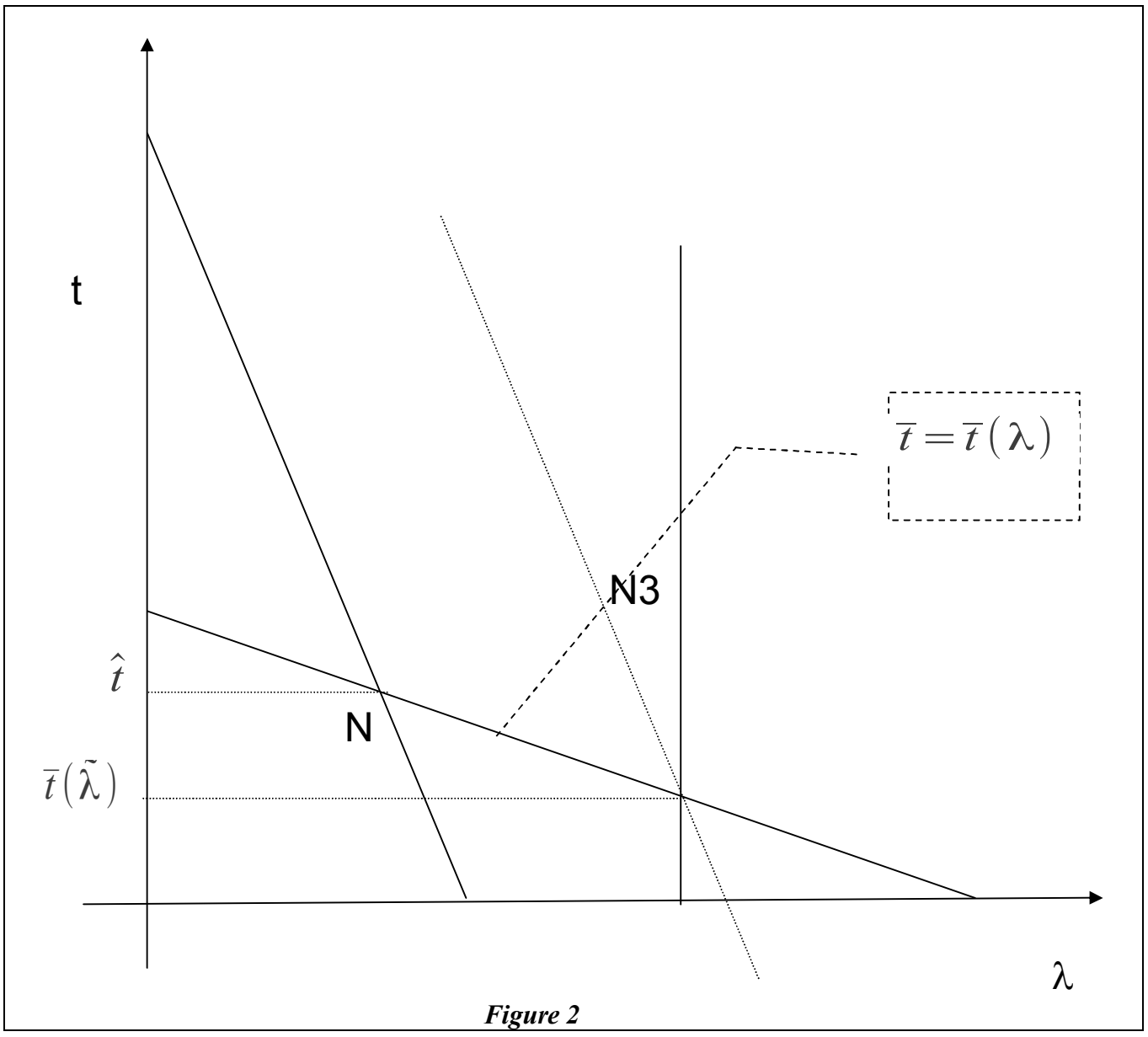


Figure 2

Graphically, in the electoral period, the reaction function of the Regional Government moves to the right; the new Nash equilibrium is the point N3.

3. The empirical analysis

3.1 Data

Data on Italian regional public health expenditure and ordinary financing since 1990 are got from the ISTAT database "Health for All - Italy", that is part of a program managed by World Health Organization. Data for '80s are sought into other sources that sometimes differ the definition of public health expenditure used in the Health for All database (HFA): the average yearly expenditure per capital of USL (local health care units) provided by Ministry of Economy and Finance (*Relazione generale sulla situazione economica del Paese*). The data on USL expenditure may underestimate expenditure since they do not give count of inter-regional mobility settlements.

Data on deficits are computed as simple differences among the annual expenditure and the ordinary financing. They have been controlled and corrected for the period 2001-2009 using the data of CERGAS.

All financial data are expressed in euro, in per capita terms and real 2000 terms by using the GDP deflator.

The variables that may give count of structural changes for the Italian HCSs at regional level for the period 1982-2009, are: the regional GDP, the regional proportion of the population over age 65, the regional male and female life expectancy[4], the regional public hospital beds per thousand inhabitants. The source for these data is the Health for All database and, for the public hospital beds per thousand inhabitants, the ISTAT time series "Sanità e Salute \ Strutture sanitarie e ricoveri" (Health \ Health facilities and hospitalizations).

We use several different proxies to capture the institutional changes that affect the "game" between Italian Central and Regional Governments: a time dummy for the institutional break that signs the transition from the so called first Italian Republic to the so called second Italian Republic (D_92)[5], equal to 1 from 1992 to onwards; a dummy variable for measuring the "political alignment" effect (D_GOV), equal to 1 when the coalitions in charge at the regional level and a the central level are the same; a dummy variable to consider the effects of the introduction of the IRAP (D_IRAP) equal to 1 from 1998 to onwards [6].

To describe the effect of the electoral cycle we define a dummy variable (ELER),

[4] In the estimations here presented, the variable "life expectancy" does not appear. It seems not really significant for our analysis.

[5] In previous versions of the same research (see for example the version that we presented in Marseille at11th Journées Louis-André Gérard-Varet, 18-20 June 2012) we also consider two other dummies: a dummy "Euro" (D_EURO), equal to 1 in 1997 and 0 for all the remaining years; a time dummy for the adjustment period to Maastricht and the European rules on debt and deficit (D_MAAS), equal to 1 from 1994 onwards. Our last empirical analysis shows that their effects are captured by D_92 and D_IRAP.

[6] IRAP (Imposta Regionale sulle Attività Produttive / Italian Regional Production Tax) was instituted under Italian Legislative Decree 446/97. It affects companies exercising productive activities, and is applied to a tax base calculated from the value of net production deriving from activity performed locally. IRAP does not have a pre-determined use. It serves the general finances of the region. According to the data contained in the most recent Bank of Italy report, the tax yield in 2009 was €31bn, out of total current income for the local administrations of €93bn. There are also some provisions stipulating that IRAP rates be raised "automatically" in the event of shortfalls in the healthcare budget (e.g. pursuant to Article 13 of the protocol agreement entered into between the Italian government and Regions on 3 December 2009 instituting external administration for Regions in deficit). Note that the dummy variable D_IRAP, as we defined, may also capture the effects of the so called second reform of the Italian HCS (d.lgs. 19th June 1999, n. 229)

equal to 1 in the year of the regional election and 0 elsewhere. The variable Fiscal Autonomy is taken from the ISTAT time series "Finanze degli Enti Locali \ Bilanci delle Regioni e delle Province Autonome"(Finance of Local Authorities \ Final balance sheets of regional and autonomous provincial governments), where it is called "Tax Imposition Autonomy"; the index is given by the ratio between tributary revenues and current revenues multiplied by 100.

We summarize the variables in the following box:

VARIABLE	DESCRIPTION
t	Regional ordinary financing from Central Government for Health Care System/Regional GDP
λ	Regional deficit/ Regional expenditure
GDP	Regional gross domestic product
Pop65	Regional proportion of population over age 65
Pop	Regional total population
BEDS	Regional public hospital beds per thousand inhabitants
LE	Regional life expectancy, computed as an average among female and male life expectancy
Per capita Y	Regional per capita GDP
Fiscal Autonomy	Index given by the ratio between tributary revenues and current revenues multiplied by 100.
D_GOV	"Political alignment" effect
D_92	Italian Second Republic effect; from 1992 to onwards
D_IRAP	Effect of the IRAP introduction
ELER	Effect of the regional election

Box 1. *Legenda*

3.2. The empirical strategy

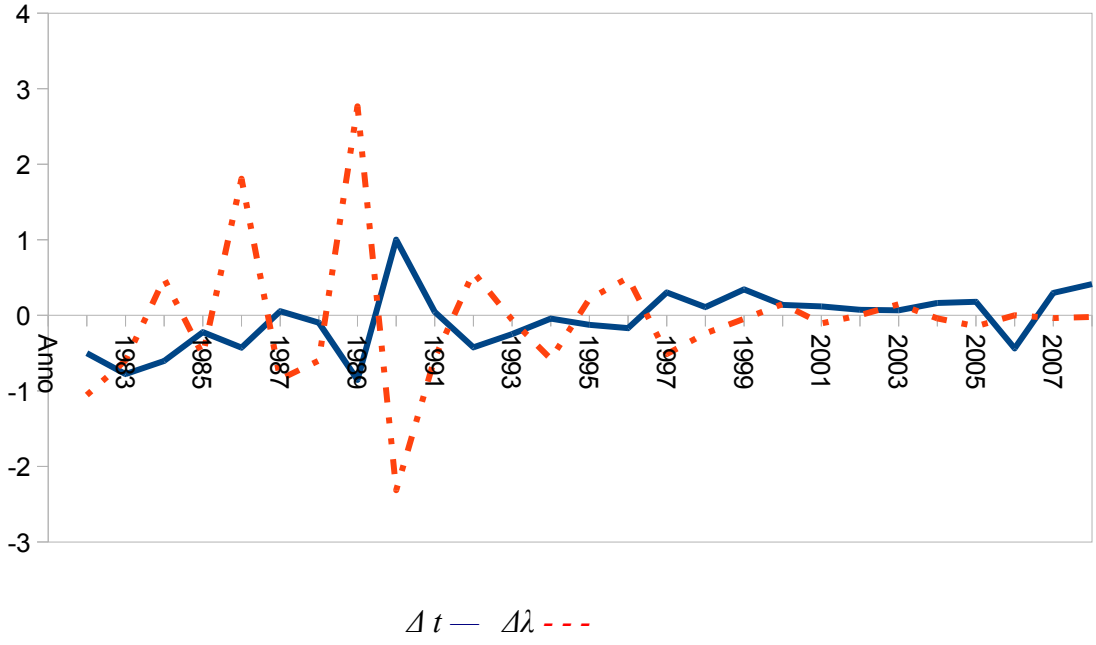
Our empirical analysis is based on Italian regional public health care expenditure and funding over the years 1982-2009. The estimations are computed only for the 15 Italian Regions with ordinary statute: Piemonte, Lombardia, Liguria, Veneto, Emilia Romagna, Toscana, Umbria, Marche, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria. The rules to fund the so called Regions with special statute are too different.

Firstly, we propose to test the above propositions from 1 to 5 using a three stages least square estimation of a two equations dynamical system. This methodology avoids the problem of endogeneity among t and λ in the estimations.

We test a simultaneous two equations model where the dependent variables are respectively Δt and $\Delta\lambda$., Since the level of λ in the first past year is important to explain the change of λ in the present[7] and because both t and λ are integrated variables, then the system that we define has the characteristic that the deviation of the current state from its long-run relationship explains short-run dynamics. In other words we propose to describe the dynamical system using an error correction model (ECM)[8].

[7] On this point see van Elk, Mot and Franses 2009, that investigate the impact of several factors on health care expenditures in an empirical analysis using an error-correction model.

[8] For the theoretical properties of the ECM see for instance Cappuccio and Orsi 1991, pp. 300-318.



Our computation on Italian Ministry of Economy and Finance data 1982-2009 controlled and corrected for the period 1990-1009 using the data of HFA, and for the period 2001-2009 using the data of CERGAS .

Figure 3. *Δt and Δλ in Italy.*

Coherently with our theoretical analysis (see particularly figure 1 and 2), the basic idea is that the reaction function of the Regional Government and the reaction function of the Central Government represent the short run dynamics, while the Nash equilibrium represents the long run relationship[9].

Subsequently, we propose to test the above proposition 6 using a reduced form of the previous ECM.

To test propositions from 1 to 5 we propose eleven different models (see Table 1):

Models I, II and III try to explain Δt and $\Delta\lambda$ using different structural variables and the effect of the regional election on $\Delta\lambda$ equation.

Models IV and V represent two modifications of the model III by adding the same dummies on both the equations.

Models VI represents a modification of the model III by adding the dummies D_92 and D_Gov on $\Delta\lambda$ equation, and the dummy D_IRAP on Δt equation.

Model VII represents a modification of the model III by adding the Fiscal Autonomy variables on both the equations.

Model VIII represents a modification of the model VI by adding the Fiscal Autonomy variables.

Model XI represents a modification of the model VI adding the fixed effects.

Model X represents a modification of the model VIII adding fixed effects.

Finally to avoid the over-identifications problems and to maintain the fixed effects that improve the results of the estimation, we propose model XI as a modification of the

[9] The reduced form described the long run relationship in the ECM. Note that the estimations we did show that the lag of the independent variable is not significant in the long run. In other words we are assuming that the co-integration does not exist.

model X where: 1. we add the lag variables - λ (-1) and t (-1) - in both Δ*t* and Δλ equations; 2. we eliminate from Δ*t* equation the Regional per capita GDP variables; 3. we eliminate the Fiscal Autonomy variables; 4. we eliminate the ΔBEDS variable because we suspect a problem of endogeneity.

Regarding the reduced form, we will show the results for five different models (see Table 2).

3.3. The results

Table 1 presents the results of our estimations to explain what are the variables that may explain the changes in Regional HCS' ordinary funding (Δ*t*) and the changes in Regional strategy (Δλ).

They are consistent with our first theoretical predictions: the Central Government transfers are depending by structural variables, as the theory affirms. In the model XI all the structural variables are captured *de facto* by the variable BEDS(-1). It is important to note thay all the models show that Δ*t* increases when Δλ decreases, stressing the importance of this relationship.

Not surprisingly, the dummy D_IRAP has positive effects on Δ*t*.

The whole analysis confirms that the most significant institutional dummy to explain Δλ is D_92: after 1992 Central Government transfers for the HCS tend to be reduced. This result is in line with Bordignon and Turati (2009). But also D_Gov is significant and suggests that Regions increases λ when Central Government has their same political position.

Again as in Bordignon and Turati (2009) we may confirm absolutely that the fixed effects seems very relevant[10].

The structural variables - Δ (Pop65/Pop), (Pop65/Pop)(-1) and BEDS(-1) - seems partly able to explain the Regions decision regarding the optimal deficit rate.

All the estimated models suggest that ELER is undoubtedly a significant variable in the explanation of Δλ: in the short run the electoral period are one of the most important factor that induces the regional incumbent to increase λ.

Model XI seems a parsimonious convincing solution.

All propositions from 1 to 5 are confirmed by the results of our estimations. Model XI seems particularly consistent with proposition 3: actually an increase in transfer implies a lower necessity to run debt by Regions; consequently the optimal deficit rate increases, when the Central Government funding are decreasing.

Table 2 shows the reduced forms of the models that are consistent with proposition 6: *during electoral periods Central Government reduces health care transfer (t) to Region.* This is also the meaning of the negative sign of ELER. Moreover, the estimation of the reduced forms suggests that when the fiscal autonomy is increased and thus when we define a better division of the responsibilities about HCS's financing, it is possible to reduce the tendency towards HCS's deficit both in the short and in the long run.

[10] After the introduction of the Fiscal Autonomy variables in the model VII and VIII, then the Hansen-Sargan test, used to check for over-identifying restrictions, does not pass. We have the same problems introducing the fixed effects with and without the Fiscal Autonomy variables in model IX and X.

	I		II		III		IV		V	
	Δt	Δλ	Δt	Δλ	Δt	Δλ	Δt	Δλ	Δt	Δλ
Const	-0,070 [0,1018]	3,253 [0,0036]***	0,294 [0,0035]***	1,353 [0,1892]	-0,094 [0,602]	-1,520 [0,458]	-0,074[0,6944]	-0,082 [0,97]	-0,300 [0,1336]	-0,602 [0,8114]
Δλ	-0,039 [8,73 e-013] ***		-0,043 [6,05 e-015] ***		-0,041 [3,91 e-015] ***		-0,041 [2,96e-015]***		-0,042 [1,61e-015]***	
λ (-1)		-0,662 [2,24 e-09] ***		-0,626 [2,96 e-011] ***		-0,628 [9,73 e-013] ***		-0,668 [1,44e-012] ***		-0,643 [2,01e-010] ***
Δt		0,077 [0,9826]		-1,153 [0,6737]		-1,925 [0,468]		-0,814 [0,7738]		-1,426 [0,6477]
t (-1)	-0,015 [0,0051]***		-0,0182683 [0,0008] ***		-0,017 [0,0011] ***		-0,017 [0,0013]***		-0,015 [0,0059]***	
EleR		**2,938 [6,52 e-05]*** **		**2,510 [0,0002]*** **		**2,231 [0,0006] *** **		**2,221 [0,0010]*** **		**2,294 [0,0006]*** **
Δ Regional Per Capita Y	-4,602 e-06 [0,0982] *		-4,843 e-06 [0,0643] *		-5,046 [0,0476] **		-5,212e-06 [0,046]**		-4,968e-06 [0,0527]*	
Region Per Capita Y(-1)	3,892 e-06 [0,0150] **		1,344 e-06 [0,4088]		8,737 [0,6165]		9,212e-07 [0,6087]		8,04108e-07 [0,6469]	
ΔGDP		5,915 e-07 [0,9789]								
GDP(-1)		-1,109 e-05 [0,3160]								
ΔPop		-1,262 e-06 [0,9445]								
Pop (-1)		1,248 e-07 [0,5102]								
Δ BEDS			0,045 [0,5079]	2,174 [0,0060]***		2,136 [0,004] ***	0,043 [0,5095]	2,093 [0,0063]***	0,074 [0,2671]	2,033 [0,007]***
BEDS (-1)			-0,049 [0,0002]***	0,311 [0,1916]		0,232 [0,327]	-0.050 [0,0037]***	0,057 [0,8154]	-0,012 [0,4825]	0,117 [0,6115]
Δ (Pop65/Pop)					0,643 [2,92 e-06] ***	8,367 [2,57 e-06] ***	0,651 [3,23 e-06] ***	8,652 [1,41e-06] ***	0,745 [1,83e-07]***	7,766 [0,0005]***
Pop65/Pop (-1)					0,012 [0,1175]	0,065 [0,4124]	0,012 [0,1164]	0,126 [0,1394]	0,005 [0,5056]	0,0897 [0,2878]
Δ Fiscal Autonomy										
Fisc. Auto. (-1)										
D_92							-0,026 [0,7291]	-1,807 [0,0469]**		
D_IRAP									0,197 [0,0198]**	-0,875[0,5144]
D_Gov										
Fixed Effects	No	No	No	No	No	No	No	No	No	No
R^2	0,189	0,368	0,216	0,408	0,258	0,458	0,258	0,445	0,268	0,452
Adj. R^2	0,181	0,356	0,204	0,400	0,243	0,448	0,241	0,434	0,251	0,441
Breusch-Pagan	14,5258 [0,0001]		52,0282 [0,0000]		51,8066 [0,0000]		28,1746 [0,0000]		43,0872 [0,0000]	
Hansen-Sargan	3,1664 [0,8692]		1,88926 [0,5957]		0,674888 [0,8791]		0,574353 [0,9023]		0,597268 [0,8971]	

Table 1 (first part)

	VI		VII		VIII		IX		X	
			Δt	Δλ	Δt	Δλ	Δt	Δλ	Δt	Δλ
Const	-0,322 [0,1049]	-1,720 [0,4564]	-0,171 [0,3544]		-0,321 [0,1227]	-1,795 [0,4469]	-0,7106 [0,2466]	-47,182 [6,04e-08]***	-0,788 [0,2036]	-49,367 [1,09e-08]***
Δλ	-0,040 [3,23e-015]***		-0,042 [9,20e-016]***		-0,039 [1,25e-014]***		-0,029 [1,47e-013]***		-0,030 [1,79e-014]***	
λ (-1)		-0,642 [5,31e-016]***		-0,561 [2,85e-011]***		-0.652 [3,18e-014] ***		-0,770 [9,10e-048]***		-0,787 [1,84e-048]***
Δt		-1,776 [0,4307]		-4.296 [0,0774]*		-1,482 [0,5420]		-2,529 [0,0112]**		-2,609 [0,0083]***
t (-1)	-0,014 [0,0088]***		-0,014 [0,0037]***		-0,0141 [0,0103]**		-0,308 [1,47e-013]***		-0,313 [2,41e-027]***	
EleR		**2,391 [0,003]*****		**1,982 [0,0007]*****		**2,437 [0,0003]*****		**2,302 [0,0001]*****		**2,254 [0,0002]*****
Δ Regional Per Capita Y	-4,733 e-06 [0,0623]*		-1,391e-05 [0,005]***		-6,767e-06 [0,3235]		-3.181e-06 [0,1546]		-1.852e-06 [0,763]	
Region Per Capita Y(-1)	7,641e-07 [0,6624]		-7,480 e-06 [0,0497]**		3,535e-06 [0,6209]		7,506e-07 [0,6389]		-3,755e-06 [0,5708]	
ΔGDP										
GDP(-1)										
ΔPop										
Pop (-1)										
Δ BEDS	0,072 [0,277]	2,016 [0,0067]***	0,068 [0,3048]	1,951 [0,0089]***	0,064 [0,332]	2,004 [0,0071]***	0,164 [0,0054]***	2,757 [7,14e-05]***	0,173 [0,0036]***	2,655 [0,0001]***
BEDS (-1)	-0,010 [0,592]	0,044 [0,8417]	-0,028 [0,0874]*	0,0611 [0,7783]	-0,013 [0,5128]	0,020 [0,9272]	0,137 [1,01e-05]***	1,768 [2,53e-06]***	0,141 [8,48e-06]***	1,628 [1,53e-05]***
Δ (Pop65/Pop)	0,751 [1,16e-07]***	8,938 [1,22e-07]***	0,720 [4,76e-07]***	9,163 [6,52e-07]***	0,715 [6,06e-07]***	8,614 [2,17e-06]***	0,127 [0,3549]	12,024 [3,75e-015]***	0,132 [0,338]	11,367 [1,98e-013] ***
Pop65/Pop (-1)	0,004 [0,574]	0,163 [0,0593]*	0,009 [0,2157]	0,095 [0,2689]	0,005 [0,5471]	0,193 [0,0413]**	0,040 [0,0761]*	2,073 [1,87e-09]***	0,046 [0,0519]*	2,297 [5,00e-011] ***
Δ Fiscal Autonomy			0,005 [0,0473]**	-0,010 [0,522]	0,001 [0,7894]	-0,008 [0,6039]			-0,001 [0,7547]	-0,013 [0,3705]
Fisc. Auto. (-1)			0,004 [0,0291]**	-0,002 [0,828]	-0,001 [0,6383]	-0,007 [0,5252]			0,002 [0,568]	-0,029 [0,0101]**
D_92		-1,545 [0,0622]*				-1,528 [0,0728]*		-5,321 [7,43e-08]***		-5,712 [8,87e-09] ***
D_IRAP	0,219 [0,0071]***				0,255 [0,0899]*		0,408 [7,61e-07]***		0,348 [0,0221]**	
D_Gov		0,892 [0,0966]*				0,951 [0,0838]*		1,072 [0,0446]**		1,069 [0,0429]**
Fixed Effects	No	No	No	No	No	No	Yes ***	Yes ***	Yes ***	Yes ***
R^2	0,269	0,466	0,262	0,461	0,273	0,463	0,453	0,552	0,453	0,561
Adj. R^2	0,252	0,454	0,243	0,449	0,253	0,448	0,420	0,525	0,417	0,532
Breusch-Pagan	46,4235 [0,0000]		129,752 [0,0000]		35,5905 [0,0000]		32,6635 [0,0000]		38,1908 [0,0000]	
Hansen-Sargan	3,80264 [0,7034]		3,46248 [0,3257]		13,1719 [0,0404]		24,2126 [0,0005]		24,5646 [0,0004]	

Table 1 (second part)

	XI	
	Δt	Δλ
Const	-0,0127031 [0,9840]	-45,2661 [6,23e-05]***
Δλ	-0,00799740 [0,4386]	
λ (-1)	0,0199798 [0,0284]**	-0,502887 [8,21e-07]***
Δt		-13,4080 [8,59e-05]***
t (-1)	-0,316970 [3,17e-27]***	-3,62898 [0,0013]***
EleR		**2,34846 [0,0004]***
Δ BEDS		
BEDS (-1)	0,0875680 [0,0034]***	1,92793 [0,0002]***
Δ (Pop65/Pop)	-0,119836 [0,4655]	7,99736 [0,0008]***
Pop65/Pop (-1)	0,0184025 [0,4439]	2,58214 [1,98e-07]***
Δ Fiscal Autonomy		
Fisc. Auto. (-1)		
D_92		-6,20954 [8,05e-07]***
D_IRAP	0,374901 [5,06e-05]***	
D_Gov		0,944247 [0,0715]*
Fixed Effects	Yes ***	Yes ***
R^2	0,4333	0,399
Adj. R^2	0,4023	0,363
Breusch-Pagan	215,185 [0,0000]	
Hansen-Sargan	0,636333 [0,7275]	

Table 1 (third part)

	I		II		III		IV		V	
	Δt	Δλ	Δt	Δλ	Δt	Δλ	Δt	Δλ	Δt	Δλ
Const	−0,040 [0,4004]	2,742 [3,48e-7] ***	−0,033 [0,8681]	−1,507 [0,4793]	−0,063 [0,7538]	−0,548 [0,8007]	−0,304 [0,2060]	−0,950 [0,7105]	−1,341 [0,0996] *	−48,953 [1,34e-7] ***
λ (-1)		−0,573 [6,47e-32] ***		−0,596 [2,61e-35] ***		−0,609 [7,70e-36] ***		−0,605 [1,71e-36] ***		−0,825 [9,35e-55] ***
t (-1)	−0,016 [0,0063] ***		−0,017 [0,0034] ***		−0,017 [0,0038] ***		−0,016 [0,0088] ***		−0,335 [1,14e-24] ***	
EleR	**−0,102 [0,1176]**	**3,239 [7,04e-6]** ***	**−0,115 [0,0734]** *	**2,685 [0,0001]** ***	**−0,113 [0,0754]** *	**2,737 [7,93e-5]** ***	**−0,113 [0,0834]** *	**2,886 [4,76e-5]** ***	**−0,110 [0,0526]** *	**2,701 [2,85e-5]** ***
Δ Regional Per Capita Y	−4,87e-6 [0,1040]	4,273e-6 [0,8954]	−5,534e-6 [0,0593] *	3,844e-6 [0,9027]	−1,857e-5 [0,0016] ***	1,026e-4 [0,1038]	−5,492e-6 [0,0604] *	−4,303e-6 [0,8902]	−8,585e-6 [0,2449]	1,041e-5 [0,8995]
Regional Per Capita Y (-1)	3,87e-6 [0,0253] **	−1,763e-5 [0,3464]	6,700e-7 [0,7416]	−1,002e-6 [0,9623]	−4,518e-6 [0,3468]	1,018e-4 [0,0500] *	4,794e-7 [0,8121]	4,537e-6 [0,8295]	−3,398e-6 [0,6644]	1,224e-4 [0,1634]
Δ BEDS			−0,077 [0,2778]	2,335 [0,0021] ***	−0,062 [0,3884]	1,999 [0,0093] ***	−0,042 [0,5576]	2,018 [0,0085] ***	0,092 [0,1541]	2,266 [0,0016] ***
BEDS (-1)			−0,048 [0,0020] ***	0,313 [0,0605] *	−0,037 [0,0524] *	0,0691 [0,7325]	−0,009 [0,6965]	−0,0760 [0,7622]	0,145 [3,90e-05] ***	1,191 [0,0024] ***
Δ (Pop65/Pop)			0,436 [0,0032] ***	7,276 [5,67e-6] ***	0,459 [0,0031] ***	6,375 [0,0001] ***	0,557 [0,0004] ***	7,414 [1,22e-5] ***	−0,054 [0,7216]	8,654 [4,82e-8] ***
Pop65/Pop (-1)			0,012 [0,1475]	0,047 [0,5925]	0,011 [0,2096]	0,079 [0,3742]	0,006 [0,5176]	0,191 [0,0561] *	0,091 [0,0140] **	2,536 [5,31e-9] ***
Δ Fisc. Auto.					0,0082 [0,0108] **	−0,062 [0,0734] *			0,003 [0,5196]	−0,020 [0,6711]
Fisc. Auto. (-1)					0,003 [0,2922]	−0,059 [0,0351] **			0,0018 [0,6866]	−0,0870 [0,0804] *
D_92							−0,012 [0,8863]	−1,603 [0,0655] *	−0,185 [0,0592] *	−6,823 [4,55e-9] ***
D_IRAP							0,236 [0,0113] **	−1,150 [0,2391]	0,261 [0,1581]	−2,188 [0,2895]
D_Gov							0,0220 [0,6894]	1,183 [0,0444] **	−0,0334 [0,5089]	1,181 [0,0382] **
Fixed Effects	NO	NO	NO	NO	NO	NO	NO		YES ***	YES ***
R^2	0,046	0,366	0,102	0,417	0,116	0,426	0,117		0,349	0,542
Adj. R^2	0,037	0,360	0,083	0,405	0,093	0,411	0,092		0,302	0,509
Breusch-Pagan	30,5327 [0,0000]		36,3647 [0,0000]		33,5701 [0,0000]		35,7549 [0,0000]		35,3066 [0,0000]	

Table 2

4. Concluding remarks.

The *bailing out* game among Central and Regional government will lead to a refinement of our empirical methodology and will suggest if it will be relevant in the debate on the reform of the Italian Health Care System.

Our study seems confirm that the tendency to create deficits characterizes the evolution of the health system in Italy, but the regional electoral cycles increase this trend.

Our empirical methodology, particularly the proposal to describe the relationship among Government funding and Regional strategy as an ECM, seems coherent with the theoretical framework here presented. We think it represents an useful approach for a long period analysis of the Italian Health Care expenditure and funding. It is only a starting point, not only because we are quite far to propose policy implications, but particularly because our research must take into account the empirical testing of the *bailing out* phenomenon that we did not consider in this paper.

A deeper research towards these directions may be very important for designing policy interventions, and to support an important political principle: only a better division of the responsibilities about the Health Care System's financing between Central Government and Regions can reduce the instability that political-electoral cycles, in all probability, introduce.

Appendix

Proposition 1: *The optimal tax rate* $\bar{t}$ *is decreasing on deficit rate* λ *when health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus an increase in deficit implies a waste of resource and reduces the incentive to transfer money to Regions. We may consider this behavior as the reaction function of Central Government.*

Proof. Since $\frac{d\bar{t}}{d\lambda}=-\frac{W_{t\lambda}}{W_{tt}}$, thus $sign\left(\frac{d\bar{t}}{d\lambda}\right)=sign\, W_{t\lambda}$. Thus since it is easy to demonstrate that $W_{t\lambda}=-Y\frac{d^2b}{dt\,d\lambda}c_C+Y^2\left(1+\frac{db}{dt}\right)\frac{db}{d\lambda}c_{CC}+\frac{Y}{P}h_H+\frac{Y}{P}(1+\lambda)\frac{tY}{P}h_{HH}$ which is negative when health care and private consumption are complement, i.e. when the price elasticity of health care is low.

***

Proposition 2: *When the cost of health care p increases, the optimal tax rate* $\bar{t}$ *increases if health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus, when the demand for health care is rigid an increase in its cost implies that National Government will transfer more to Region in order to grant a good level of health care.*

Proof. Since $\frac{d\bar{t}}{dp}=-\frac{W_{tp}}{W_{tt}}$, thus $sign\left(\frac{d\bar{t}}{dp}\right)=sign\, W_{tp}$. Thus since it is easy to demonstrate that $W_{tp}=-(1+\lambda)\frac{Y}{p^2}-(1+\lambda)\frac{Y}{p^2}H\,h_{HH}>0$ when health care and private consumption are complement, i.e. when the price elasticity of health care is low.

***

Proposition 3: *The optimal deficit rate* λ *is decreasing on transfer t when health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus an increase in transfer imply a lower necessity to run debt by Regions. We may consider this behavior as the reaction function of Regional Government.*

Proof. Since $\frac{d\bar{\lambda}}{dt}=-\frac{W_{t\lambda}}{W_{\lambda\lambda}}$, thus $sign\left(\frac{d\bar{\lambda}}{dt}\right)=sign\, W_{t\lambda}<0$. Thus since it is easy to demonstrate that $W_{t\lambda}=\frac{Y}{P}h_H+\frac{Y}{P}(1+\lambda)\frac{tY}{P}h_{HH}$ which is negative when health care and private consumption are complement, i.e. when the price elasticity of health care is low.

***

Proposition 4: *When the cost of health care p increases, the optimal deficit rate* λ *increases if health care and private consumption are complement, i.e. when the price elasticity of health care is low. Thus, when the demand for health care is rigid an increases in its cost implies that Regional Government will run bigger deficit in order to grant a good level of health care.*

Proof. Since $\frac{d\bar{\lambda}}{dp}=-\frac{W_{\lambda p}}{W_{\lambda\lambda}}$, thus $sign\left(\frac{d\bar{\lambda}}{dp}\right)=sign\, W_{\lambda p}$. Thus since it is easy to demonstrate that $W_{\lambda p}=\frac{-tY}{p^2}-\frac{tY}{p^2}H\,h_{HH}>0$ when health care and private consumption are complement, i.e. when the price elasticity of health care is low.

***

Proposition 5: *The optimal deficit rate decreases when the toughness of fiscal rules increases.*

Proof. The proof comes from $W_{\lambda\theta}=-I_{\lambda\theta}<0$

***

Proposition 6: *During electoral periods national government reduces health care transfer to Regions.*

Proof. The solution for transfer rate is $\check{t}<\hat{t}\,,with\,\check{t}\in[\bar{t}(\tilde{\lambda});\hat{t}]$, see the figure 2.

***

Proposition 7: *During electoral periods National Government raises the tax rate for reducing the debt, thus he bails out the debt of Region.*

Proof. When the debt constraint is binding, the solution for b is $b = \lambda t - \Gamma$. Since $(1+\tilde{\lambda})\check{t}=(1+\hat{\lambda})\frac{p_2}{p_3}\hat{t}>(1+\hat{\lambda})\hat{t}$, thus $\tilde{\lambda}\check{t}>\hat{\lambda}\hat{t}+(\hat{t}-\check{t});\,with(\hat{t}-\check{t})>0$, thus $\tilde{\lambda}\check{t}>\hat{\lambda}\hat{t}$ and $\check{b}>\hat{b}$

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