IMPLICATIONS OF GLOBAL BUDGET PAYMENT SYSTEM ON NURSING HOME COSTS

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Abstract

The increasing pressure on health care systems due to the growing expenditure of the elderly population pushed policy makers to consider new payment systems to contain future health care costs. The impact of prospective payments (PPS) on nursing home care is a crucial issue. We investigate this issue using a panel data set of 41 nursing homes in Southern Switzerland observed over a 12-years period from 1999 to 2010. To evaluate the impact of the recent policy change - from retrospective to prospective payment - on nursing home costs, we adopt two empirical approaches: i) we estimate a model using a fixed-effects estimator (FE) with a time trend that is allowed to change after the policy reform; ii) we use a counterfactual approach (CF) following the idea of Horowitz (2007). The panel structure is taken into account by adjusting standard errors with the cluster robust estimator. The analysis shows that the new payment system led to a reduction in the rate of cost increase. Also, similar evidence is found by applying the counterfactual approach in which a fixed-effects model is used to estimate costs for the years prior the reform, and the impact of the reform is calculated as the difference between observed- and predicted costs in each year.

Keywords: nursing homes, prosepctive payment, costs, quality of care, policy change

JEL classification: I18, C23, L3

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1 Introduction

Population ageing is changing the age structure of the population of all western countries and challenging their long-term care systems. In Switzerland, the percentage of people over 64 during the 20th century rose from 5.8% (1990) to 16.9% (2009) (Swiss federal Statistics, 2012) while the percentage of people aged 80 or over experienced the highest increase, from 0.5% to 4.8%. Accordingly, the demand of nursing home care is expected to increase raising the burden on public finances since cantons grant financial resources in the form of subsidies.

To control future cost inflation policymakers stepped recently to consider new payment systems. In the last 30 years high hopes have been pinned on the possibility to control expenditure by replacing Retrospective (RPS) with Prospective Payment Systems (PPS). Under PPS, a predetermined, fixed amount of resources is paid for a particular service. The rationale is that reimbursements based on ex-ante costs to provide a specific service prevent health care organizations from giving unnecessary care.

PPS were firstly introduced in the US through the Social Security amendments of 1983 for the Medicare program of hospitals, and later on extended to the nursing home sector (1997) through the Balanced Budget Act. Similarly, many European countries have recently incorporated more incentivizing payment systems into their existing funding systems (Cylus and Irwin, 2010). In Switzerland, an increasing number of cantons moved to PPS, both in the hospital and in the Nursing Home (NH) sectors. While for the hospital sector the Swiss parliament revised the insurance law to introduce a DRG system in all cantons, the provision of nursing home care is still determined at the cantonal level. In 2006, the cantonal authority in the Italian speaking part of Switzerland (Ticino) substituted the previously-in-force payment system based on the "recognized financial need" (RPS) with an ex-ante determined budget (PPS).[1] The budget is obtained by multiplying regulated prices derived from the analytical accounting by service quantities. The main aim of the cantonal authority is to increase managerial autonomy, motivation, responsibility and, therefore, efficiency in the nursing home sector moving from a system based on inputs control to one based on outputs The

[1] Two other cantons recently introduced PPS in the nursing home care: Vallis and Geneva.

objective of this paper is to study the impact of the new payment system on the nursing homes costs controlling for the quality of the services provided.

The challenge of any policy evaluation analysis consists in constructing an appropriate counterfactual. For this purpose, panel data methods suitable for non experiemental data are considered (Blundell and Dias, 2000; 2009; Nichols, 2007). In addition, we provide the results of an analysis inspired by the counterfactual approach proposed by Horowitz (2007) applied to energy sector.

The remainder of the paper is organized as follows. Section 2 provides an overview of recent studies analyzing the impact of PPS on costs, quality and access to health care services. Section 3 describes the regulatory reform in more detail and proposes a simple model to infer the behavior of NHs under the old RPS and the new PPS. Data and descriptive statistics are provided in section 4. In section 5, we discuss the identification strategy for the policy change and define the cost function and the econometric specification. The results are presented in section 6. Section 7 concludes.

2 Previous research on the impact of PPS in nursing homes

A social experiment conducted in San Diego, U.S., on a sample of thirty-six proprietary NHs at the beginning of the 80s showed that NHs do respond to monetary incentives (Norton, 1992). In particular, the study shows that an adequate payment system design can improve quality and keep costs under control. One year later, within the framework of the Clinton health care reform in the begin of the 90s, Ellis and McGuire (1993) suggest that the use of PPS should be preferred to demand-side incentives. The main argument in favor of supply-side cost sharing is that they do not force patients to bear greater risk of illness and monetary loss. However, the empirical evidence is not conclusive regarding the impact of PPS on costs, quality and access to NHs services. Most of the literature relies on studies conducted in the U.S. in the 80s and beginning of the 90s; when PPS were firstly introduced. The first strand of studies focused mainly on the financial consequences of PPS by looking at changes in costs (e.g. Sexton et al., 1989; Ohsfeldt, Antel and Buchnan, 1991). More recently, stronger attention has been devoted to the understanding of cost reduction achievements. Improved methods to control for changes in quality and to cope with the potential endogeneity of output and/or quality in cost functions have been proposed (Gertler and Waldman, 1992; Chen and Shea, 2002). Also, direct assessment of the impact of PPS on quality (Konetzka et al., 2004; Konetzka et al., 2006) and access to nursing care (Coburn et al., 1993) have been carried out.

Sexton et al. (1989) use a two steps strategy to regress the DEA-calculated efficiency scores on the change of the payment system occurred in the State of Maine in 1982. They find a decrease in technical efficiency. Quality variations are assumed to be negligible. Ohsfeldt et al. (1991) exploit variations in the payment systems of 47 U.S. states over a 12-years period. After correcting for endogeneity of the reimbursement system with instrumental variable in a random effects model, they find a reduction of 20 per cent in per diem costs due to PPS.

Coburn et al. (1993) extend the traditional cost analysis by looking at the consequences on quality and access to care for Medicaid patients in the State of Maine. There are some interesting results. First, regression analysis shows that PPS strongly contributed in reducing the growth in per-patient variable costs. Second, during the first three years after the introduction of PPS, the average savings and losses per patient day decreased substantially. Afterward, they observe an important increase in the number of NHs experiencing losses. Third, only the percentage of room and board costs relative to the total variable costs decreased over time, suggesting that cost savings were not achieved through reductions in quality. Finally, they report a decrease in the percentage of Medicaid patients and interpret it as negative impact on the access to care for the most severe patients.

Some concerns about results obtained in the 90s are raised by Chen and Shea (2002), who questioned the methodology used. In particular, they point at the inadequate measures of quality and output/quality endogeneity in cost functions. To cope with the endogeneity issue, the authors construct instrumental variables for both output and quality, and investigate the impact of PPS on short-term operating costs. The analysis is performed on a one-year data set of different U.S. states grouped into three different payment systems. The authors show that after controlling for quality differences, NHs with PPSs are no longer significantly cheaper than facilities under a cost-based retrospective payment system.

More recently Zhang et al. (2008) assess the impact of PPS at the national level on the cost efficiency of 8'361 U.S. NHs over the period 1997-2003. During this period, three major policy changes occurred: in 1997 the Balance Budget Act (BBA) ratify the introduction of PPSs. Afterward, the Balanced Budget Refinement Act (BBRA, 2000) and the Benefit Improvement and Protection Act (BIPA, 2001) increase the baseline payments in consequence of the financial difficulties reported by NHs. Quality differences are captured by weighting the output with a score calculated using the number of deficiency citations. DEA calculated efficiency scores are regressed on policy change variables identified with time markers and a truncated random effect model is applied. The results show a negative relationship of all policy change variables with efficiency scores.

Growing strand of literature investigates the impact of PPS and BBRA on quality aspects of nursing home care. Konetzka et al. (2004) use changes in professional staffing and the number of regulatory deficiencies as proxies for quality. Using data on U.S. NHs over the period 1996-2000, they investigate the impact of PPS on quality by applying a difference-in-difference approach and a negative binomial model respectively. As expected, PPS is found to significantly reduce the professional staff. The negative impact of PPS is partially corrected by BBRA. With respect to regulatory deficiencies, only weak evidence is reported. Also, no differences between for-profit and nonprofit NHs are found. Finally, Konetzka et al. (2006) investigate the spillover effects of introducing PPS in Medicare residents on quality for Medicaid patients. Since facilities cross-subsidize part of the costs of Medicaid residents with the higher margins of Medicare and high private-pay residents, the cuts in revenue due to the introduction of PPS may also have affected quality also of long-stay residents. Using a quasi-experimental approach in four U.S. states over the priod 1995-2000, the authors show that PPS has an adverse effect on urinary tract infections and pressure sores.

To conclude, the economic literature remains inconclusive as with respect to the impact of PPS. Also, it is worth pointing out that most of the studies mentioned are based on the U.S. data which is characterized by a high share of private, for-profit facilities and an increasing competitive environment (Konetzka, 2004). This may lead to different behavioral responses as compared to nonprofit institutions. In particular, NHs may react differently with respect to quality. In fact, the expected negative impact of cost reductions on quality may be partially offset by the need to maintain a high reputation in competing with other facilities.

3 Empirical analysis

3.1 Econometric strategy

In order to choose the most adequate model specification, a series of tests were performed on the NH dataset. We adopt two approaches: a fixed effect model (*Approach 1*) and the counterfactual approach inspired by the study of Horowitz (2007). The latter consist of measuring the impact of the new payment system as difference between mean predicted and mean observed total costs (*Approach 2*). Following the literature on forecasting with panel data (Baltagi, 2008), we know that the FE predictor performs well in sample of comparative size and is close to the best, GLS predictor. Therefore, we estimate a FE model as specified in eq.(3) for the year prior the introduction of PPS and use the coefficients to predict the costs afterward. We estimate:

$$y_{it} = X_{it}^{T}\ \delta_T + v_{it} \qquad\qquad \text{for} \quad \text{t} \leq 2006 \tag{1}$$

with the same cluster robust estimator as specified above. Then, using the estimated coefficients $\widehat{\beta}_T$, we predict costs for each NH i in each year t.

$$\widehat{y_{it}} = X_{it}^{T}\ \widehat{\delta}_T \qquad\qquad \text{for} \quad \text{t>2006} \tag{2}$$

and finally compute the impact of the reform as costs difference between mean observed costs and mean predicted costs ($\overline{y}_{it} - \overline{\widehat{y}}_{it}$) in each year separately. Note that we allow for nonliner predictions. In this way, we can compute the impact of PPS in each year. Standard errors are corrected using the cluster robust estimator.

3.2 Model specification

Our study builds on data extracted from annual reports delivered to the cantonal authority by all regulated NHs scattered in Canton Ticino, Switzerland. The initial data set contains 50 NHs observed over a 12-years period (1999-2010) covering the 7-year period before and the 5-year period after implementation of global budgets. From this initial sample, we exclude few NHs in which a considerable share of the output (patient-days) is produced in foyers. Foyers are external residential apartments where the most « in-health » patients get nursing care. Therefore, the production process might differ a lot. Three NHs show unreasonable values for some variables of interest and are therefore dropped.[2] Finally, we exlcude from the analysis the four NHs selected for the pilot phase. First, because the pilot phase was mainly intended to set down the rules of the new payment system and understand its functioning. The new payment system was introduced stepwise and adjusted over time. Therefore, it is not possible to consider these observations as « control group », besides from the fact that they would result in too few observations.[3] Second, these NHs were not randomly selected from the sample.

We specifiy a cost model where the NH transforms two inputs, capital and labor, into a single output, measured by the number of patient-days of nursing care.[4] The number of patient-days can be considered as exogenous because NHs are local monopolies and due to subsidized prices, the sector is characterized by excess demand.with occupancy rates around 100 per cent. Moreover, since the production process is highly homogenous among NHs, the number of resident-days is a good indicator of the level of production. The total costs function depends on output (Y), the prices for capital and labor (P_k and P_l), a time trend (τ), two output characteristics (Q_1 and Q_2) and a dummy variable (D) which takes value equal to 1 for the years following the introduction of PPS (i.e. for t$\leq$ 2006), and 0 otherwise.[5]

$$C = f(Y, P_k, P_l, \tau, Q_1, Q_2, D). \tag{3}$$

[2] services in form of private, for-profit institutions and then accepted to be subordinated to the cantonal regulation and get subsidized. Since this implies a change in the production process, values were not comparable

[3] over a 3-years period resulting into 15 observations.

[4] A similar approach is followed, for instance, by Farsi and Filippini (2004).

[5] In a non-competitive environment such as the Swiss one, there is no reason to assume that NHs minimize costs. In this case, the estimated costs function is a "behavioral cost function" (Evans, 1971) and can still be used to make a comparison among firms. Moreover, by estimating a total costs function instead of a variable costs function we avoid the risk related to a possible high correlation between capital stock and output leading to a positive relationship between variable cost and capital stock (Filippini, 1996).

The dummy variable D is included only in the specification of the cost function of *Approach 1*. The price of labor is calculated as the weighted average wage of different professional categories employed in the NH (doctors, nurses, administrative and technical staff), while the price of capital is derived from the residual approach: labor costs are subtracted from total costs and the residual is divided by the capital stock approximated by the number of beds.

Additionally, we control for some output characteristics that may explain cost differences across NHs.[6] Q_1 is an index which measures average patients assistance by means of normal daily activities such as eating, personal care or physiological activities. This is calculated on a yearly basis by the cantonal authority. Patients are classified in one out of five categories according to their severity level. A value between 0 and 4 is assigned where higher values indicate more severe cases. Q_2 is the nursing staff ratio, that is the ratio between the number of nurses employed in a NH and the number of nurses that should be employed according to the guidelines of the cantonal authority. Because nursing care is a labor-intensive service, the ratio can be considered as a good indicator of quality.(see for example Johnson-Pawlson & Infeld, 1996; Schnelle et al., 2004). Labor costs represent the major cost voice of NHs and make about 85 per cent of total costs. Consequently, a small change in the nursing staff ratio may affect total cost considerably. The nursing staff ratio is therefore a key variable in the present analysis since NHs with high costs may decide to decrease the proportion of workers to save money. If this is the case, then the estimates would suffer from endogeneity bias. We test the endogeneity of this regressor by performing the robust Durbin-Wu-Hausman test. The test is robust to arbitraily violations of conditional homoskedasticity and clustering and consits in estimating the model as a Generalized Method of Moments (GMM) estimator and applying the Sarfan statistic. We perform this test using the lagged of Q_2 as instrumental variable. The test statistic is chi-squared distributed with a robust score $\chi^2(1) = 0.49$ or $F(1, 234) = 0.395$. The null hypothesis of exogenous Q_2 cannot be rejected at any standard levels of significance.

Time-invariant variables such as the organizational form do not show up in

[6] In order to estimate a cost function, either the output is assumed to be homogenous or we need to control for service intensity and patients' characteristics (Birnbaum et al., 1981).

the cost function because it is not possible to estimate their parameters with the FE model.

Assuming the following specification of the time trend for the period before the change in the payment system (i.e. $t < 2006$) and for the period afterward (i.e. $t \geq 2006$)

$$\tau = \begin{cases} \delta_0 + \delta_t t & : \quad t < 2006 \\ (\delta_0 + \delta_d) + (\delta_t + \delta_{td})t & : \quad t \geq 2006 \end{cases} \tag{4}$$

and including it into our cost function, we get:

$$C = \delta_i + X_{it}^T\ \delta_T + \delta_d D + \delta_t t + \delta_{td}\ tD + v_{it}. \tag{5}$$

where X_{it}^T is the vector of explanatory variables as defined in (3). A number of considerations can be made based on (5). First, the time trend for the period before the policy change is obtained by setting $D = 0$. In this case. the constant term of the time trend (δ_0) cannot be identified because it is captured by the individual-effects (δ_i). After the reform, $D = 1$ and the time trend assumes the form specified in the second row of eq.(4). Second, this specification allows both the constant (δ_d) as well as the intercept (δ_{td}) of the time trend to change after the policy reform. If we impose $\delta_{td} = 0$ we restrict the policy change to affect only the constant term (average impact). We refer to these two model specifications as *unrestricted FE model and restricted FE model.*[7]

In order to impose as few restrictions as possible, we adopt a flexible translog functional form approximated at the median value. Input prices and total costs are divided by the capital price in order to satisfy the homogeneity condition in

[7] We also perform a battery of specification tests. First, we check whether the reform affected other coefficients by building interaction terms of each explanatory variable with the dummy D; but we do no find evidence. An alternative approach would consist of estimating two different models, one before the reform and one after the reform, and compare the coefficients. However, this strategy would allow individual-effects to be different between the two periods, which is not desirable. Second, we perform a stochastic frontier approach estimating different models such as the pooled frontier with Mundlak correction (Farsi,

Filippini and Greene, 2005; Farsi, Filippini and Kuenzle; 2005) or the true random effect model). The impact of the reform is analyzed in two ways: first, we introduce the dummy variable into the deterministic part of the frontier and second, we compare calculated mean inefficiencies by means of the non parameteric Kruskal-Wallis test. In all the model specifications and independently on the approaches used, we find evidence that the payment system reduced total costs.

input prices.[8] The translog approximation to eq.(3) is:

$$\begin{aligned}\ln\left(\frac{C}{P_k}\right) &= \delta_0 + \delta_Y \ln Y + \delta_{Q_1}\ln Q_1 + \delta_{Q_2}\ln Q_2 + \delta_{P_l}\ln\frac{P_l}{P_k} \\ &+\frac{1}{2}\delta_{YY}(\ln Y)^2 + \frac{1}{2}\delta_{Q_1Q_1}(\ln Q_1)^2 + \frac{1}{2}\delta_{Q_2Q_2}(\ln Q_2)^2 \\ &+\frac{1}{2}\delta_{P_lP_l}\left(\ln\frac{P_l}{P_k}\right)^2 + \delta_{YQ_1}\ln Y\ln Q_1 + \delta_{YQ_2}\ln Y\ln Q_2 \\ &+\delta_{YP_l}\ln Y\ln\frac{P_l}{P_k} + \delta_{Q_1P_l}\ln Q_1\ln\frac{P_l}{P_k} + \delta_{Q_1Q_2}\ln Q_1\ln Q_2 \\ &+\delta_{P_lQ_2}\ln\frac{P_l}{P_k}\ln Q_2 + \delta_t t + \delta_d D + \delta_{td}\, tD + \delta_i + v_{it}\end{aligned} \tag{6}$$

The concavity condition in input prices is checked after estimation.

4 Results

The regression analysis allow us to control for factors that may explain variation in costs over time not related to the change in the payment system. In this way it should be possible to disentagle the general increase in costs from the impact of the policy change. We present the estimated coefficients of the *restricted*- and *unrestricted* FE models as specified in (6) in Table (1). The number of observations (N) and the model fit statistic $R^2 - within$ are also provided.

Since the first-order coefficients are very similar in both specifications, we restrict the discussion of these coefficients to the *restricted* FE model. The output coefficient (δ_Y) measures the total costs elasticity with respect to output. A value lower than 1 suggests the presence of unexploited economies of scale in the NH sector. In the present case, it indicates that an increase of 10% in the number of resident-days would increase total costs by about 8.75 per cent.

The parameter estimates of the output characteristics (δ_{Q_1}, δ_{Q_2}) show a positive, highly-significant value meaning that total costs increase with the severity of patients and the quality of the service provided, i.e. the relative number of nurses assisting patients. These coefficients can also be interpreted as elasticities with respect to total costs. The case-mix coefficient (0.285) indicates that a 10% increase in patients severity increases costs by almost 3%. More important, a

[8] The cost function is linear homogenous of degree 1 in input prices when a 10% increase in all input prices leads to a 10% increase in total cost.

Estimated coefficients	restricted FE	Std.Err.	flexible FE	Std.Err.
δ_Y	0.875***	16.58	0.863***	0.051
δ_{Q_1}	0.285***	0.060	0.281***	0.059
δ_{Q_2}	0.409***	0.049	0.471***	0.050
δ_{P_l}	0.779***	0.026	0.795***	0.026
δ_{YY}	0.122	0.218	0.084	0.210
$\delta_{Q_1Q_1}$	0.540**	0.210	0.540***	0.198
$\delta_{Q_2Q_2}$	0.204	0.440	0.115	0.422
$\delta_{P_lP_l}$	0.201**	0.095	0.211**	0.086
δ_{YQ_1}	-0.030	0.206	0.009	0.196
δ_{YQ_2}	0.534***	0.140	0.556***	0.139
δ_{YP_l}	0.055	0.077	0.062	0.078
$\delta_{Q_1P_l}$	0.418*	0.243	0.372	0.223
$\delta_{Q_1Q_2}$	-0.172	0.349	-0.077	0.323
$\delta_{P_lQ_2}$	-0.219	0.202	-0.249	0.204
δ_t	0.010***	0.002	0.015***	0.002
δ_d	-0.020***	0.007	0.076***	0.023
δ_{td}	-	-	-0.012***	0.003
δ_0	15.483***	0.017	15.385	0.017
N	471		471	
R^2	0.915		0.920	

Notes: Significance levels: * = 10%, ** = 5%, *** = 1%.

Table 1: Results of the fixed effect and first-difference models.

10% increase in the nursing staff ratio leads to a total costs increase of 4%. The relative input prices coefficient is positive and significant, meaning that the costs function is monotonically increasing in the vector of input prices. This coefficient provides infromation on the percentage of labor costs over total costs of a representative NH. The estimated share of labor costs is around 80%, which is very close to the actual sample mean (83%). Consequently, the share of capital costs is around 20%. of total costs. Before moving to the interpretation of the second-order coefficients, consider the time trend coefficient. The estimated parameter is highly significant and indicates that on average, each year the NH sector total costs increase by 1% due to the inflationary costs.

Consider now the main coefficients of interest: δ_t, δ_d, δ_{td}. In the *restricted FE model*, the underlying assumption is that the new payment system affected only the mean level of costs, but not its evolution. As you can see in Table (1), costs have increased by 1% pro year over the whole period of analysis. However, the the coefficient of the dummy D is negative and highly significant, suggesting that the reform reduced mean total costs by 2% from year 2006 to 2010. Consider now the results of the *flexible FE model*. The time coefficients shows that costs have increased by 1.5% (δ_t) per year.until year 2006. Afterward, both the intercept (δ_d) as well as the slope (δ_{td}) of the total costs trends have changed. The intercept of the time trend increased by 7.6%, but its slope decreased by 1.2% pro year. Since D=1 only from year 2006, the whole effect of the reform is: 0.076-0.012*t, where $t \geq 8$. The total effect of the reform in each year is: -0.02 (t=2006), -0.032 (t=2007), -0.044 (t=2008), -0.056 (t=2009) and -0.068 (t=2010). The total cost change over time after the reform is instead given by the derivation of the cost model with respect to t, i.e: 0.015t-0.012D where D=1. After substituiting for t, we get: 0.108, 0.123, 0.138, 0.153 and 0.168.

We now consider the results of the counterfactual analysis. In table (2) is reported the impact of the reform as defined in the first row of eq.(4) and the 95% CI (Min95, Max95). The values show in table (2) correspond to the jointly estimation of the coefficients of δ_D, δ_{td}[9]. It emerges that the magnitude of the coefficients is very similar to the results from the FE models previously discussed. Although the coefficients of the first two years are not statistically signicant, a clear pattern arises for the years 2008. 2009. 2010.

The counterfactual analysis can be visualized in Figure (1). On the y-axis we report observed log costs while on the y-axis the log costs predicted by the model defined in (2) in each year. As you can see, in the period preceding the reform of the payment system, actual costs and predicted costs curves are very similar, suggesting that the specified cost model is adequate. From year 2006 on, the two curves diverges.

	2006	2007	2008	2009	2010
Min95	0.034	0.023	-0.006	-0.007	-0.016
Mean	-0.020	-0.035	-0.062	-0.065	-0.078
Max95	-0.077	-0.093	-0.118	-0.123	-0.140

Table 2: Counterfactual analysis and confidence intervals.

It is important to note that D gives the mean impact over the whole period considered after the policy change (2006-2010). Unfortunately, this identification

[9]By imposing linear predictions, the value of Z is assessed at -0.322, which is closer to the result obtained with the *restricted* FE model. Nonlinear predictions allow us to model the impact of PPS in a more flexible way.

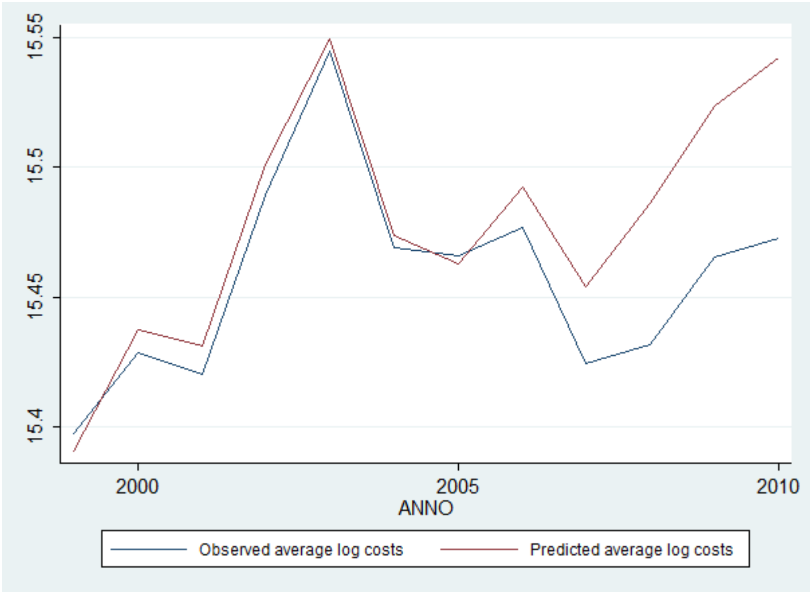

Figure 1: Observed log total costs versus predicted log total costs.

strategy does not allow us to shed further light on the speed and shape of its impact over time.

5 Conclusions

Long term care is under pressure due to the increasing expenditure for the elderly population. Prospective payments (PPS) may help to contain future costs in the nursing home sector. We investigated the impact of PPS in the form of global budget payment on the costs of providing nursing home care using a panel data set of 41 nursing homes from Southern Switzerland observed for a 12-years period from 1999 to 2010. The analysis showed that, after controlling for the nursing staff ratio, the new payment system has an impact on both the intercept and the slope of the cost evolution. Consequently, we found evidence that the PPS led to a reduction in the rate of cost increase. Also, similar evidence is found by applying the counterfactual approach in which a fixed-effects model is used to estimate costs for the years prior the reform, and the impact of the reform is calculated as the difference between observed- and predicted costs in each year.

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