THE FINANCING SYSTEMS AND THE PERFORMANCE OF PORTUGUESE HOSPITALS

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SUMMARY

The main objective of this study is to analyse the impact of financing systems on the performance of Portuguese hospitals. In particular, to analyse the impact of these systems on costs per admission and per patient day, and also on average length of stay and number of admissions. This is an aggregate approach of the hospital care industry where the hospital is the unit of analysis. The study is based on a sample of panel data (36 hospitals over the 1985-1994 period), used to estimate a behaviour cost function. It is concluded that costs per admission have decreased over the time period and that length of stay was the main factor influencing it.

KEY WORDS – hospitals; financing systems, prospective payment

INTRODUCTION

In major markets providers of commodities are paid directly by consumer's out-of-pocket money. This is not the rule in health care markets where, usually, a third party pays the services and/or goods exchanged between providers (doctors) and consumers (patients). Hence, the third party performs a very important role in the market of health care and has a significant impact on the performance of this sector.

Concern with the rising costs of hospital care, during the last 1970s and early 1980s, has prompted increasing interest in alternative forms of financing hospital services in Portugal. In fact, the financial environment of the Portuguese hospitals has been subjected to gradual changes during the 1980s and early 1990s. In 1981 there was a move from direct payment, based on pre-determined schedules and costs incurred, to prospective payment by the implementation of hospital budgets, based on hospital output (average cost by specialty and individual services). In 1990, a new process of allocating budget, based on a less heterogeneous measure of output, the diagnosis related groups (DRGs), was gradually introduced into the system. These latter developments have been defended on the grounds of a more equitable distribution of funds among hospitals and as an attempt to improve the efficiency of the public hospital sector, in which a lack of cost-saving incentives to providers and users has been increasingly recognized.

The Portuguese DRG financing mechanism has been criticized by Costa [1], questioning its apparent effectiveness and adequacy. However, surprisingly, there is only one empirical study evaluating the impact of the DRG system on hospital performance [2], and another one analyzing the technical and allocative efficiency of the hospital sector [3].

The main purpose of this study is to evaluate the impact of the financing schemes, introduced in 1980 and 1990, on hospital performance. In particular, we will analyse its effect on unit costs, length of stay and admissions.

THE PORTUGUESE HOSPITAL FINANCING SYSTEM

During the last decades, the Portuguese hospitals have been experiencing different financing systems which have created the current pattern of hospital costs. Presented in Table 1 is a summary of the major features that characterise three different periods of hospital financing.

During the 1970s, hospitals were reimbursed by different funding sources: (i) by patients or their families, (ii) by the Social Security, for care provided to patients under social security schemes, on a per diem basis and according to pre-determined schedules; (iii) by the counties, for care provided to the poor, and (iv) by the public budget which provided the most of the revenue. Since hospitals could determine the number of patient days and services provided, there was no incentive to improve efficiency. In general, and except for care provided to patients under the Social Security Scheme, hospitals were paid according to the costs incurred.

In 1981, a new financing system was implemented with the aim to improve the management and efficiency of hospitals [4]. Prices were set according to the average costs of two different groups of hospitals (Central hospitals and District hospitals). Within each category the pricing system was based on the average cost of each medical speciality, adjusted for average length-of-stay and rate of occupancy, allowed varying within pre-determined limits. External consultations, urgencies and ancillary services were paid according to prices set yearly on the basis of average costs. The first two, according to the number of patients attended, ancillary services on the basis of clinical procedures performed. Hotel services were also priced on the basis of average costs and paid by inpatient day. Following the above criteria and based on past activity, economical budgets were elaborated for the coming year. However, a second budget, the financial budget, was also usually established taking into account the caps imposed by the public budget [5].

Table 1. Hospital reimbursement schemes

Unit of Payment	Reimbursement Schemes		
	1970-1980	1981-1989	1990 onwards
	Direct Payment	*Prospective Payment (Budget+Direct Payment)*	*Prospective Payment (Budget+Direct Payment)*
Inpatient days	Pre-determined schedules	-	-
Urgencies External consultations	Pre-determined schedules (fee-for-service)	average cost (fee-for-service)	average cost (fee-for-service)
Ancillary services	Pre-determined schedules (fee-for-service)	average cost (fee-for-service)	-
Hotel services	Pre-determined schedules (per patient day)	average cost (per patient days)	-
Other services	Hospital specific costs	hospital specific costs	hospital specific costs
Per Case	-	average cost **per specialty** (with limits)	**DRGs**

Despite its positive impact on the number of admissions, length of stay and occupancy rates, this budget allocation process is usually criticised by the measure of hospital output adopted, based on medical specialities, which is considered to be a heterogeneous category of output. A further criticism is related to the financing of ancillary services by fee-for-service which induces the over-consumption of services and the substitution of more expensive to cheaper diagnostic tests. Over time, this financing method has led to significant differences in the cost of treating individual cases among the Portuguese hospitals, without any reward to administrators and hospitals that had achieved increased efficiency in treating their patients [6].

Thus, in 1990, a new budget allocation scheme began to be implemented on the ground of a more homogeneous measure of hospital output: the DRG based resource allocation system.

Under this system patients are grouped, according to their diagnosis, into one of the 477 DRG classifications. Patient classification into different groups is also based on several characteristics: the major body system affected, whether surgery was performed, the principal diagnosis, the age of the patient, any secondary conditions and the discharge status. Cases grouped in each diagnostic category should have similar hospital length of stay and intensity of resource consumption, which means that the treatment costs for patients within each group should be similar. Therefore, under this resource allocation mechanism, prices are set for the entire inpatient episode and not individually for each input used during the episode (e.g., bed days, pharmaceuticals, and X-rays) [6].

In a DRG-based system, every case assigned to a specific DRG is paid on the basis of an average cost computed for the whole country. However, since treatment costs have significant differences among hospitals, the application of this financial model in Portugal, without a transition period, would have a considerable impact on the Portuguese hospitals in that some of them would have large and sudden decreases in funding, while others would have large increases. Therefore, it was established that, during each year of the transition period, hospital appropriations would consist of larger percentages of the payment being based on hospital specific costs. Specifically, in 1990 this proportion would be 90%, with only 10% of the resources, allocated for inpatient care, based on national average cost [6].

It is worth noting that since the publication of this plan, the financing of hospitals has been kept in the secrecy of the Central Financing Department and we do not have any notion about what is its course and how it will be in the future. It seems that political reasons have been preventing the publication of financial information concerning the funding of hospitals. To our knowledge, with the exception of lists, comparing the length of stay in each DRG across hospitals, no any other information concerning the performance of different hospitals has been published.

However, since 1990, an increasing part of hospital revenue has been regulated directly by DRG schedules. It concerns the treatment provided to patients enrolled in health schemes outside the National Health System, the insurance funds, which cover about 20 percent of the population. Therefore, in some way, hospital performance has been affected since 1990 by the DRG financing scheme.

PREVIOUS RESEARCH

Most of the empirical studies, about the impact of rate-setting legislation on hospital costs, have been developed in the United States and have used the state or the county as the unit of analysis. In most of them prospective payment systems were effective in sustaining costs and utilisation. Melnick, *et al.*[7] concluded that these payment systems have sustained costs. Coelen and Sullivan [8] have also evidence that, under this financing mechanism, rates of growth in hospital costs have been reduced. Rosko [9] found that the New Jersey prospective system was successful in reducing annual costs per unit of output. The analysis developed by Rosko and Broyles [10] has also suggested that the DRG program has reduced costs per admission and per day and increased the number of admissions. This study continues this line of empirical research with the necessary adjustments to the Portuguese case.

It should, however, be noted that most of the studies carried out in the United States compare hospitals funded by retrospective payment systems (in which payment is done according to cost incurred) with hospitals financed by prospective systems (with prices pre-determined before care is provided). The latter include either the funding by budget, per patient day, per admission or per DRGs .

In the Portuguese case, it is in the 70s that the financing system is more closed to the retrospective one. The other two periods are clearly prospective. As data were available only after 1985, we could not compare the 70s with the other two time periods. Therefore, our study evaluates hospital performance over the period 1985-1995 and compares two periods, before and after the introduction of DRGs, as well. Our analysis follows the following stages: firstly we will describe the empirical model, followed by the description of the sample. Finally we will discuss the results.

EMPIRICAL ANALYSIS

The equations to be estimated, to analyse the impact of prospective payment per case on hospital performance, rely on the following general model. As a reduced-form equation it specifies

hospital output (number of admissions and the number of patient days) as a dependent variable, since it is assumed that the payment system will have an impact on hospital performance.

$$P_{it} = \alpha + \beta' X_{it} + \gamma D_t + \delta H_i + \varepsilon_{it}$$

where $i = 1,\ldots,36$ denotes the thirty six hospitals and $t = 1,\ldots,10$ denoting time, P_{it} is a measure of performance of the ith hospital during the tth year, X_{it} a vector of control variables representing demand and supply variables (e.g. age, income, size, wage), D_t a vector of dummy variables for years, H_i a vector of dummy variables taking the value 1 if hospital identification number equals i, and zero otherwise, ε_{it} the error term, α the model intercept, and β, γ, and δ vectors of parameters.

A linear functional form was used in the estimation of four separate regressions which include the following measures of hospital performance: expenditures per case, expenditures per patient day, average length of stay and the number of admissions.

To properly assess for the impact of prospective payment, several control variables were included in the model. Thus, the coefficients of variables such as age, income, and infant mortality rate capture the impact of demographic and economic characteristics as well as the health status of the population resident in the district where the hospital is operating. The coefficients of size, input prices and staff per bed estimate the effect of hospital characteristics on unit costs, length of stay and cases treated. The coefficients of the hospital binary variables measure the impact of omitted, hospital specific variables, which are assumed invariant over time. In turn, the regression coefficients of the year binary variables measure the effects of changes in the payment system, assumed to stay constant across hospitals.

The Dependent Variables

A listing of the dependent and independent variables, examined in this study, is given in Table 2 (in Appendix).

The bulk of our empirical work consists of four regressions with cost, output and utilisation as dependent variables. Two proxies, representing the ratio of total hospital inpatient expenditures

(adjusted by the public expenditure deflator) to the number of patients admitted yearly and patient days, measure the two cost dependent variables. Capital expenditures were subtracted from total expenditures, since a specific program finances capital goods and they are not supposed to be influenced by the financing mechanisms used to funding hospitals. Further items, subtracted from the total, were expenditures on medicines prescribed in external consultations, which were paid by the Regional Health Authorities before 1990, and also estimated costs on outpatient and emergency room visits. Both cost per case and cost per day are reported, because the payment systems (i.e., the speciality and the DRG payment schemes) may have different effects on specific cost components. However, under both payment systems, which affects primarily the length of stay, a substantial effect is expected on cost per case and a negligible or opposite effect on cost per day.

Output regression dependent variable is CASES, measured by the yearly total admissions to the hospital, and is reported to capture the impact of the reimbursement system on the number of patients admitted per period. Similarly, the utilisation regression dependent variable, represented by ALOS, permits to test the effect of both payment systems on the number of days the patient stays in the hospital.

The Independent Variables

The independent variables isolate the effect of inter-hospital characteristics and demand conditions on hospital performance. Exogenous variables in all four regressions include four demand variables, describing factors that reflect the need for health care (POP>65 and IMRate), the inducement of demand (GPs) and the ability to pay for health care (PPIndex). The Portuguese public hospitals are obliged to treat all the patients in their area of referral, which corresponds to the patient area of residence. Therefore, the four variables are intended to capture the impact of health, demographic and economic characteristics of the population living in the District where the hospital is located.

The proportion of district population aged 65 and over (POP>65), reflect population groups who tend to consume more health care because of their age and to be admitted more often

to the hospital. Therefore, this variable is expected to have a positive regression coefficient in all four regressions. United States studies, examining the impact of prospective payment systems, have suggested that age is a significant determinant of hospital costs and utilisation. Sloan and Steinwald [11] found a positive relationship between the percentage of county population proportion age 65 and over and costs per day and per admission. Another study by Melnick *et al*. [7] also found a positive relationship between age and total hospital expenditures and between the former variable and number of admissions. The infant mortality rate (IMRate) is a proxy for the population health status and is intended to reflect the need for health care. Accordingly, the coefficient of this variable should be positive in every model estimated. A study conducted by Estelle et al. [12] has found standardised mortality rate to be positively related to standardised hospital episode ratio. However, since district infant mortality variability is larger than standardised mortality, we have adopted the former variable. The number of inhabitants per general practitioner (GPs) is used to measure the impact on the demand for inpatient care, induced by the number of GPs in the district. A negative relationship between GPs and the dependent variable is expected. Number of active physicians per capita in county has been found to be positively related to hospital expenditures per inpatient day and per admission [8]. Using percentage changes in measuring dependent and independent variables, Ashby [13] has found positive elasticities between the number of physicians per 100,000 population and total costs and between the former and the number of admissions per capita. The ability to pay for health care (PPIndex) is a measure of the income for the average consumer in each district. It is expected that it may have a positive impact on unit costs as well as on admissions and utilisation. All of these variables are measured for the districts in which the hospital is located.

Four independent variables are used to control for the impact of hospital characteristics on the performance of hospitals. Total inpatient beds (BEDS) was entered in the model to account for the effects of size on unit costs, number of admissions and length of stay. Empirical literature on hospital costs reports that large hospitals are likely to attract a more complex case mix and to have higher unit costs. Thus, this variable should have a positive coefficient. Rosko [9] has found a positive relationship between number of beds and costs per inpatient day per admission. Another study found a positive elasticity between number of beds and average costs per admission [14].

Price of labour (LPrice) and supplies (OPrice) are included to account for differences in input prices across hospitals. Spending and hence unit costs, is expected to rise with these two variables. However, their impact on admissions and length-of-stay is uncertain.

Another important explanatory variable is the staff per bed (STAFF). It is a crude measure of the intensity of services provided by hospitals. Therefore, this variable should be positively related with unit costs, admissions and length-of-stay. Rosko [9] found costs per admission and number of doctors per bed to be significantly and positively related.

Case-mix and managerial skill differences should also be controlled in the analysis because they are likely to affect unit costs. However, because case-mix data were not available, binary variables (Hosp02,...,Hops36) are used to isolate the impact of this unmeasured hospital-specific characteristics, which remain unchanged over time.

To examine changes in the payment system that are likely to affect equally hospital performance over time, an additional dummy variable was included for the individual years (YR86,...YR94).

THE DATA SAMPLE

The observational unit for our empirical analysis is the individual hospital. The data set consists of a pooled sample of cross-section and time series observations covering 36 acute district hospitals, for 10 years (1985-1994): a total of 360 observations.

The primary sources of data for this study were the Ministry of Health's hospital statistics. These hospital annual surveys were used as the source of data for volume of patients, number of beds, hospital expenditures, number of personnel and cost estimates of outpatient and emergency room visits. Data for demand variables and price indexes were obtained from the annual surveys, published by the Instituto Nacional de Estatística. Information, pertaining to the purchasing power parity index, was obtained from a study published by the Instituto Nacional de Estatística for the year 1989.

RESULTS

Four different hospital cost functions were estimated and, for each of them, a two-way fixed effects econometric model was used. The evaluation of cost-containment was done for three separate cost measures (total, labour and other operating expenditures), on a per admission and per diem basis. However, only the results for total cost equations are displayed in Table 3.

Table 3 - Regression results for two-way fixed effects models

Independent Variables	Costs per admission	Costs per patient day	Average length of stay	Admissions
GPS	-0.0171**	-0.00131	-0.00081	0.08174
POP>65	7.7926***	0.60104*	0.1972**	-251.49***
IMRate	0.07457	0.0204	-0.001777	-3.4715
PPIndex	-0.3504	-0.0807	0.0226	12.496***
BEDS	0.16632***	-0.00391	0.05621***	8.2006
Oprice	0.01131***	0.00299***	-0.000347***	1.0113***
Lprice	0.0665***	0.00743***	-0.000616*	-0.50267
STAFF	54.444***	6.272***	0.3047**	-145.42
YR86	-8.264	-0.67026	-0.28854	182.67
YR87	-23.694***	-1.5175*	-0.77631***	536.55***
YR88	-57.975***	-4.8375***	-1.1822***	998.83***
YR89	-100.82***	-8.8460***	-1.9468***	1 542.4***
YR90	-124.59***	-11.697***	-2.1651***	1 669.7***
YR91	-161.31***	-14.742***	-2.9116***	1 705.7***
YR92	-180.73***	-16.844***	-3.3263***	2 388.7***
YR93	-210.45***	-19.583***	-3.6815***	2 756***
YR94	-212.10***	-19.957***	-3.6776***	2 376***
Lag. Mult. Test	224.6	178.27	491.85	537.86
Hausman Test	0.0001	0.0001	0.0001	0.0001
R^2	0.76	0.79	0.76	0.95

Note: Models with pooled data for 36 hospitals, over the period 1985-1994. Hospital dummies not shown.*** Significant at the 1% level **Significant at the 5% level * Significant at the 10% level (two-tailed test)

Prospective Payment Variables

The impact of prospective payment on hospital performance is captured by individual year dummy variables which are shown to have a significant impact on cost per case, and, except for one year, on cost per day, cases treated and length of stay. Specifically, in relation to the costs per admission, the results suggest that, after accounting for the effect of other explanatory variables, the deviations of the time dummy variables coefficients from the omitted year (i.e., year 1985) range from 8 contos to 212 contos, between 1986 and 1994. Accordingly, the costs per patient day are 1 contos lower in 1986 and 20 contos in 1994. With regards to the number of admissions, there is a positive trend throughout the period, indicating that both payment schemes induced hospitals to increase the number of admissions. The results suggest, as well, that hospitals have reduced the length of stay throughout the same time period.

Other Explanatory Variables

In general, in the unit cost and length of stay equations, the majority of the estimated coefficients of the control variables have the expected sign. The coefficients of the admission equation have some unexpected signs. However, as they are controlling variables and, therefore, not relevant for the aim of our study, we will not analyse either the magnitude or the sign of their coefficients.

Cost Savings

The regression results, stated in Table 3, suggest that hospital financing systems have been effective in sustaining costs per admission and length of stay. The findings also indicate that the number of admissions tends to increase, over the same time period, and that costs per day tend to be lower. However, a better interpretation of the regression results can be obtained by expressing

the dummy variable coefficients in terms of deviations from the estimates of the dependent variable, derived from the coefficients of the remaining explanatory variables.

Table 4 presents the annual and cumulative savings in cost per case and cost per day for both Specialty and DRG periods. The DRG cumulative effect is estimated by the difference between the coefficient for the last year before the implementation of DRGs (i.e., 1989) and the coefficient for 1994. The Specialties cumulative effect is obtained by the difference between 1986 and 1989. In both cases, the level of statistical significance of the estimated cost savings is evaluated by an approximate t-test at the conventional statistical levels.

The results for individual year estimates follow a similar pattern in both cost per case and cost per day, during the evaluation period. With the exception of 1994, in the case of cost per admission, and of 1987, in the case of cost per day, all the differences are statistically significant. The year of 1989 (before the implementation of the DRG scheme) seems to be the time period with the highest cost saving effect (a cost saving of 42.8 contos per admission and a cost saving of 4 contos per inpatient day).

If we consider the aggregate impact of both allocation schemes, i.e., the cumulative cost savings over the time periods 1986-1989 and 1989-1994, there is evidence that the Specialty and the DRG Payment Schemes contain costs per unit of output. During the time period 1986 through 1989, cumulative cost savings were estimated to be 93 contos per admission and 8 contos per day in terms of 1991 constant escudos. Similarly, over the period 1989-1994, a cost-containment effect of 111 contos per admission and 11 contos per day were found.

Table 4 - Estimated savings attributed to the prospective payment schemes for inpatient cost per admission and inpatient cost per day ***(expressed in 1991 constant escudos)***

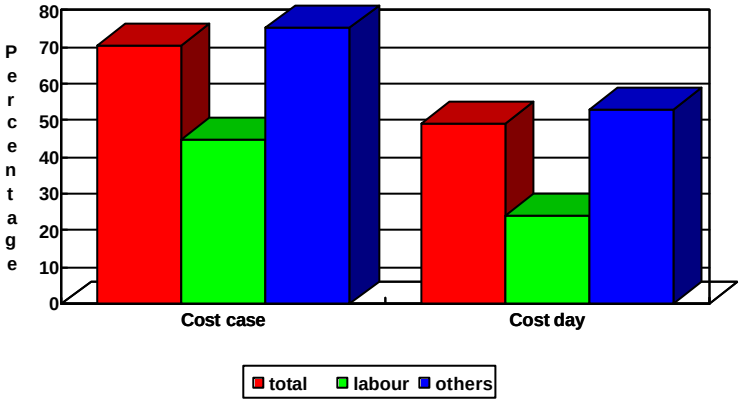
	Year	Cost per case (in contos)	Cost per day (in contos)
Individual-Year Saving			
Specialty Period	1987	-15.429**	-0.847
	1988	-34.263***	-3.32***
	1989	-42.863***	-4.008***
DRG Period	1990	-23.77***	-2.851***
	1991	-36.72***	-3.045***
	1992	-19.42***	-2.102***
	1993	-29.72***	-2.739***
	1994	-1.65	-0.37
Cumulative Savings			
attributed to the **Specialty scheme** (1986-1989)		-92.55***	-8.175***
attributed to the **DRG scheme** (1989-1994)		-111.28***	-11.111***

Note: *** Significant at the 1% level **Significant at the 5% level * Significant at the 10% level (two-tailed test)

We have also considered the percentage of the cumulative savings attributed to the different components of unit costs. The cumulative savings as a percentage of average costs attributable to the Specialty Payment System are presented in Figure 1. An analysis of the Figure shows that the negative effect of the Specialty Payment System on both components of total inpatient unit costs is quite different in terms of magnitude. Labour expenditures are twice as large on a per admission basis and relatively higher on a per patient day basis. However, the

contribution of other operating expenditures to the total inpatient estimated savings is larger than labour expenditures when both cumulative savings, as a percentage of average costs in 1989, are compared (i.e., 75 percent for other expenditures and 45 percent for labour costs on a per admission basis, and 53 percent for other expenditures and 24 percent for labour expenditures on a per diem basis). The reasons for these divergent patterns are not clear. It is likely that the smaller percentage, attributed to the labour costs, could be associated with changes in the structure of the professional careers during the last eighties and early nineties. According to the annual financial reports of the Ministry of Health the impact of these measures, in terms of financing, was considerable during the late eighties.

Figure 1 - Cumulative cost savings as a percentage of cost levels in 1989 attributable to the specialty payment system

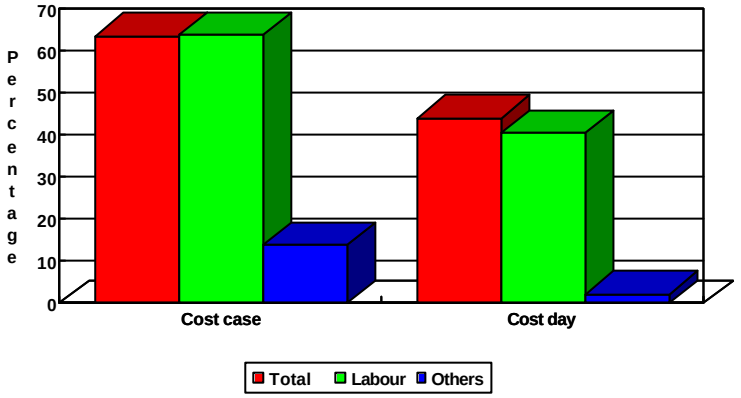


Cost Measures	Cumulative cost effect (1985-1989)	Cost level in 1989*(b)*	Cumulative effect as a percentage of 1989 cost level
Total inpatient costs	-251 174c *(a)*		
Total inpatient costs per admission	**-100.82 c**	**143.66 c**	**70.17%**
Labour inpatient costs per admission	-56.26 c	125.5 c	44.91%
Other inpatient costs per admission	-28.58 c	37.93 c	75.34%
Total inpatient costs per patient day	**-8.84 c**	**17.93 c**	**49.30%**
Labour inpatient costs per patient day	-3.77 c	15.76 c	23.92%
Other inpatient costs per patient day	-2.5 c	4.74 c	52.74%

Note: *(a)* This figure represents the cumulative cost saving of total inpatient costs obtained from the dummy coefficients of the two-way fixed effects model, run for total inpatient costs.
(b) Figures in this column are unit costs computed for the sample mean in 1981.

Figure 2 provides a similar framework to examine the cumulative savings of different components of unit costs over the DRG evaluation period.

Figure 2 - Cumulative cost savings as a percentage of cost levels in 1994 attributable to the DRG payment system



Cost Measures	Cumulative cost effect (1989-1994)	Cost level in 1994*(b)*	Cumulative effect as a percentage of 1994 cost level
Total inpatient costs	-622 593c *(a)*		
Total inpatient costs per admission	**-100.28 c**	**175.16 c**	**63.53%**
Labour inpatient costs per admission	-83.13 c	130.43 c	63.73%
Other inpatient costs per admission	-10.56 c	76.54 c	13.79%
Total inpatient costs per patient day	**-11.11 c**	**25.24 c**	**44.01%**
Labour inpatient costs per patient day	-7.59 c	18.84 c	40.28%
Other inpatient costs per patient day	-0.22 c	11.02 c	1.99%

Note: *(a)* This value represents the cumulative cost saving of total inpatient costs obtained from the dummy coefficients of the two-way fixed effects model run for total inpatient costs.
(b) Figures in this column are unit costs computed for the sample mean in 1994.

Under DRG scheme, the contribution of labour to cost containment is about eight times higher than other operating expenditures (i.e., 83 contos for labour expenditures against 11 contos for other expenditures on a per admission basis, and 8 contos against 0.22 contos on a per diem basis). However, the results suggest that the contribution of labour to total inpatient estimated savings is now higher than the other operating expenditures, when the cumulative savings, as a percentage of average unit costs in 1994, are compared. The lower contribution of other expenditures to cumulative cost savings in percentage terms could be explained by the fact that hospitals are contracting privately, catering, cleaning, security and hotel services and, hence, substituting expenditures on services contracted privately for labour expenditures.

Furthermore, an analysis of both Figures 1 and 2 provide evidence that cost per day declined less than cost per admission (i.e., 70 percent in cost per case treated against 49 percent in cost per day under specialty payment system, and 64 percent in cost per admission against 44 percent in cost per day under DRG scheme). Since, under both payment systems, hospitals are paid and the budgets are allocated per each patient admitted to the hospital, it is likely that there is an incentive to reduce costs per admission.

Changes in Length of Stay and Admissions

An examination of the impact of the prospective payment systems on length of inpatient stay and number of admissions will provide some explanation for the cumulative cost reductions experienced by District Hospitals during the evaluation period. Table 5 displays estimated changes in length of stay and admissions attributed to both payment schemes.

With regards to the average length of stay, only in 1994 there appears to be an increase in the span of time the average patient stayed in the hospital, yet this is not significant. Once again, the year 1989 seems to have experienced the highest reduction. This result helps to explain the significant yearly cost savings already found for this year. Overall, the cumulative and significant decline of 1.7 days per stay clearly support the hypothesis that both prospective payment schemes

have decreased inpatient stay. This result supports the evidence also found by Dismuke [15] for the years 1993 and 1994.

Table 5 - Estimated changes in average length of stay and number of admissions attributed to the DRG scheme

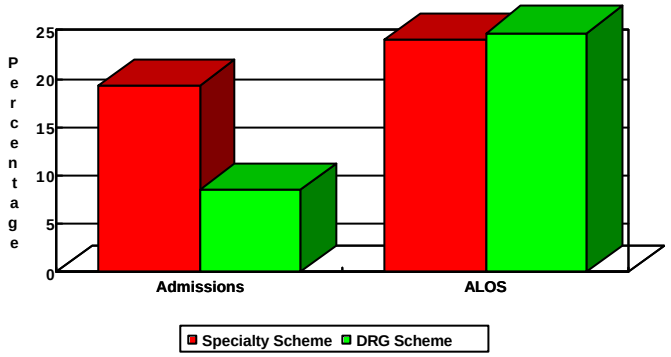
	Year	Average length of saty (in days)	Admissions
Individual-Year Changes			
Specialty Period	1987	-0.4875***	353.88*
	1988	-0.4061**	462.28**
	1989	-0.7646***	543.57***
DRG Period	1990	-0.2183	127.3
	1991	-0.7465***	36
	1992	-0.4147**	683***
	1993	-0.3552**	367.3***
	1994	0.0039	-380***
Cumulative Changes			
attributed to the **Specialty scheme** (1986-1989)		-1.6582***	1 359***
attributed to the **DRG scheme** (1989-1994)		-1.7308***	833.6

Note: *** Significant at the 1% level **Significant at the 5% level * Significant at the 10% level (two-tailed test)

Except for the year 1994, figures in Table 5 show that admissions have been increasing during the Specialty and DRG periods. However, despite the cumulative increase of 834 admissions, during the DRG period, this result is not significant.

Consider, now, the cumulative changes in both the number of patients admitted in the hospital and in the average length of stay as a percentage of the average levels of these variables in 1989 and 1994, which are presented in Figure 3.

Figure 3 - Cumulative changes in admissions and ALOS as a percentage of admission and ALOS levels in 1989 and 1994 attributable to both payment systems



Measures	Cumulative effect	Average level *(a)*	Cumulative effect as a percentage of admissions and ALOS average levels
Specialty Period	**(1985-1989)**	**(1989)**	
Admissions	1 542.36	7 960.5	19.37%
Average Length of Stay	-1.95	8.02	24.31%
	(1989-1994)	**(1994)**	
DRG Period			
Admissions	833.6	9 866.6	8.44%
Average Length of Stay	-1.73c	6.98	24.78%

Note: (a) Figures in this column are ALOS computed for the sample mean in 1989 and 1994.

The impact on the number of admissions, attributed to the Specialty Payment System, is more than twice as large as in the DRG Payment System (19 percent in the Specialty Scheme and 8

percent in the DRG Scheme). The impact on the length of stay appears to be slightly higher in the DRG period. Yet, since there is a limit to the extent the length of stay can be reduced, the percentage of increase in ALOS under DRG scheme, despite being small, is still relevant.

CONCLUSIONS

Overall, we can conclude that the significant cost-containment effect per admission was achieved by the reduction in the average length of stay and that, as a result of shorter stays in the hospital, there was an opportunity to increase admissions. Moreover, the evidence that the number of admissions to the hospital have been rising also indicates that the rate of occupancy has been growing, providing that the number of beds did not increase. This fact could also explain an increase in the efficiency in the provision of care in that there is an opportunity to allocate fixed costs to more patients.

Furthermore, the significant cumulative cost reductions per inpatient day, contrary to our expectations, suggests either that district hospitals are treating less complex and hence less costly cases or they are treating the same cases with less resources, and, hence, more efficiently. Indeed, since there is evidence that hospitals have been reducing length of stay, costs per day are expected to increase unless there is significant declines in the provision of labour and ancillary services and/or input prices, which is likely to be happening. However, the lack of detailed data compels this issue to merit attention in future work, which should account for differences in case-mix across hospitals by the inclusion, within the model, of case mix indices.

We have also considered the contribution of both cost components for cost savings as well as changes in admissions and ALOS, under both financing mechanisms. It was stated that, during the specialty period, other operating expenditures were the main determinant of cost savings. Conversely, under the DRG scheme it was the labour component, which has given the main contribution in percentage terms, an indication that hospitals are substituting expenditures on services contracted privately for labour expenditures. However, only a more detailed examination of the item "other operating expenditures" could support this implication. Therefore, further research should

consider the impact of routine and ancillary expenditures for cost increases, as well as the effect of different components of labour expenditures (namely, nurses, doctors and other staff expenditures) for cost savings. Lack of more detailed data has prevented the development of this analysis.

Regarding the cumulative changes in admissions and length of inpatient stay, it was found that under the specialty period, the number of admissions is higher and the average length of stay slightly lower, in percentage terms, than under the DRG period.

The above findings have implications for the evaluation of the DRG system as a budget setting tool and as a payment mechanism. Lately, the Ministry of Health, to keep pace with the need of extra health care funds, is questioning the financing criteria adopted. However, it is particularly pertinent to note that the DRG system was not yet adopted in full and, despite the schedule fixed by the Ministry of Health, in 1996 only 20 percent of the budget was allocated according to the DRG pricing scheme. Therefore, a longer time period and larger percentages of payment based on DRGs are needed in order to make any inference about the impact of this financing mechanism on hospital performance.

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APPENDIX

Table 2 - Variable Definition, Means, and Standard Deviation

Variables	Definition	Mean (Standard Deviation)
Dependent Variables		
Cost per case	Ratio of total inpatient expense (net of capital expenditures, and ambulatory expenditures) to admissions, expressed in 1991 constant contos.	165,42 (48,90)
Cost per day	Ratio of total inpatient expense to patient days, expressed in 1991 constant contos.	20,60 (6,12)
ALOS	Ratio of total inpatient days to admissions	8,13 (1,49)
CASES	Total admissions to the hospital	8052,14 (3688,5)
Demand Variables		
GPs	Number of inhabitants per GP in the district where hospital is located	1454 (225,16)
POP>65	District population aged 65 and over, where hospital is located (%)	14,84 (3,81)
IMRate	District infant mortality rate, where hospital is located (%)	11,96 (4,22)
PPIndex	District purchasing power index, where hospital is located	63,72 (20,77)
Supply Variables		
BEDS	Total inpatient beds	244,57 (112,84)
Oprice	Ratio of operating expenditures to 365 days	1202,2 (1095,5)
Lprice	Ratio of labour expenditures to number of personal	1787,9 (752,55)
STAFF	Ratio of number of personnel to beds	2,28 (0,79)
Regulatory Variables		
YR85,...,YR94	Binary variables: equal 1 in year indicated by the two digits	
Other Variables		
Hosp02,...Hosp36	Binary variables: equal 1 in hospital identified by the two digits	