GLOBAL BUDGETS AND PROVIDER INCENTIVES: HOSPITALS' DRUG EXPENDITURES IN TAIWAN

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ABSTRACT

Purpose – *This chapter examines how drug prescribing behavior in Taiwanese hospitals changed after the government changed reimbursement systems. In 2002, Taiwan instituted a system in which hospitals are reimbursed for drug expenditures at full price from a fixed global budget before the remaining budget is allocated to reimburse all other expenditures, often at discounted prices. Providers are thus given a financial incentive to increase prescriptions.*

Methodology – *We isolate the effect of this system from that of other confounding factors by estimating a difference-in-difference model to analyze monthly drug expenditures of hospital departments for outpatients during the years 1999–2006.*

Findings – *Our results suggest that hospital departments which use drugs more heavily as part of their regular medical care increased their drug*

Pharmaceutical Markets and Insurance Worldwide
Advances in Health Economics and Health Services Research, Volume 22, 103–122

ISSN: 0731-2199/doi:10.1108/S0731-2199(2010)0000022008

prescription expenditures after the implementation of the global budget system. In addition, we find that the response was stronger among for-profit than not-for-profit and public hospitals.

Implications – *Hospital doctors responded to the financial incentive created by the particular global budgeting system adopted in Taiwan by increasing expenditures on drug treatments for outpatients.*

INTRODUCTION

Many nations are assuming more responsibility for the health care of their citizens and as a result are struggling with rising health care expenditures. These expenditures are rising everywhere as health care becomes more technologically advanced. However, expenditures may also increase both because consumers demand more care when they face lower prices for the service, and because providers may supply more care in response to the particular reimbursement scheme adopted. Governments have experimented with a number of different strategies to address these two responses, such as co-pays for consumers and prospective payments for provider services, with the aim of controlling costs while still ensuring that citizens have access to necessary and good-quality health care. In this chapter we examine how adopting a particular strategy aimed at controlling provider costs, a global budget, affected the drug prescribing behavior of physicians in Taiwanese hospitals.

In a global budget scheme, the government sets a fixed amount of money to be paid to providers for all health care they supply in the following period. The purpose is to give providers financial incentives to contain costs: ideally, given a fixed budget, providers will work to provide health care services as efficiently as possible so as to maximize their profit (or net revenues usable to pursue other goals, in the case of public or private-not-for-profit institutions). However, providers may also respond by adjusting the volume of their services, if possible, or by changing the quality of the care offered. Much depends on the details of the specific global budget plan adopted.

In this chapter we study one aspect of health care providers' response, hospital physicians' drug prescription behavior, in Taiwan. Previous studies of the impact of global budget plans have focused primarily on the experiences of Canada and of various Western European countries. By examining the effect of global budgets in an Asian country with a very different history of government involvement in health care, we can get a

better idea of the universality of providers' responses to these types of incentive schemes.

Studying Taiwan has other advantages. Global budget schemes can be quite complicated, making it difficult to isolate provider responses. However, the incentive for hospital physicians to alter their drug-prescription decisions is fairly clear in the system adopted in Taiwan. Further, we know exactly when hospitals switched to this new reimbursement scheme, have identified a treatment group and a control group, and have data for the groups both before and after the switch.

We first provide some background with a brief discussion of global budgets and the specific global budget plan adopted for hospitals in Taiwan, particularly as it relates to reimbursement for drug prescriptions. We then discuss our methodology and specification, and describe the data sources. Finally, we present our results and end the chapter with our conclusions.

BACKGROUND

Global Budget Systems

A global budget is a target or limit set for overall spending (Poterba, 1994). Governments adopt global budgets as a response in rising health care expenditures for several reasons. First, such a budget allows the government to pre-specify the amount to be spent on health care in a period, giving it more control over its expenditures. Second, by simultaneously giving patients free access and setting the overall budget, the government forces health care providers to use their own judgment on how to use their limited budget to satisfy health care needs of their patients. Ideally, such budgets give health care providers the incentive to reduce costs by eliminating unnecessary services and increasing the efficiency with which necessary care is provided.

Studies of the impact of global budgets have tended to focus on their effect on health expenditures and on whether any cost reductions realized were achieved by reducing the quality of the service provided.[1] However, because the government cannot predetermine the amount of health care services that patients will demand when they fix the budget, they must adopt some mechanism to determine reimbursements that reconciles the fixed budget with fluctuating quantities of care, and the incentives that alternative mechanisms give to providers may be quite different.

There are two basic approaches. In one, an expenditure *target* scheme, the government pays a fixed fee (or prospective payment) for predetermined

quantities of different services. As discussed in Fan, Chen, and Kan (1998), under this approach the provider may be modeled as an individual optimizer, choosing an output level that maximizes their own profit or utility given the fee structured set by the government. In such an environment, governments must put some additional controls on supply decisions if they want to keep within their budget: for example, providers may be discouraged from supplying more than their quota if reimbursements are sharply discounted for services above the quota.

However, in an expenditure *cap* system, the budget is fixed ex ante but the reimbursement prices are determined ex post: once the services have been provided, the prices of those services are adjusted so that the fixed budget will cover them. In this type of situation, providers are in a situation similar to Cournot competitors, having to make supply decisions before knowing the price they will receive for the service, because the price of the service will be determined by the summed supply decisions of all the providers. Each provider will have an incentive to increase their supply, ignoring their marginal impact on overall price levels. The greater the number of providers, the closer prices will approach marginal cost (Fan et al., 1998). Thus, providers in this type of global budget scheme are likely to earn lower profits, particularly as the number of providers increases.

In some cases, however, reimbursement schemes contain elements of both ex ante fixed fees and ex post prices. For example, in the early 1990s Germany adopted a system to reimburse physicians in which fees for services were fixed ex ante during the first half of the year, but were reduced in the third- or fourth-quarters of the year if expenditures were exceeding the budget. In addition, physicians faced risk to their income if they, as a group, prescribed drugs whose cost exceeded the pharmaceutical budget. In such a case, the budget for physician income in the next year would be reduced by the amount the physicians had exceeded the drug budget. Physicians responded to the increased financial risk associated with prescribing drugs by reducing the number of prescriptions written and by referring patients to specialists or to hospitals, both of which were not affected by the global budget for pharmaceuticals (Henke, Murray, & Ade, 1994).

The Global Budget System in Taiwan

In March 1995, Taiwan enacted a compulsory National Health Insurance (NHI) plan that covers virtually the entire population. The NHI is designed to accomplish two objectives: to provide equal access to health care for all

citizens and to constrain total health spending to reasonable levels (Council of Economic Planning and Development, 1990). To achieve the first goal, the program reimburses providers for most medical services, including acute care, prescription drugs, dental care, and traditional Chinese medical care. Outpatients pay only a small share of the cost of their care, approximately $5 for visits to clinics and $8 for visits to hospitals, and inpatients pay 10% of the cost of their care, but with a maximum payment of 10% of the average national income per person. In addition, indigenous people qualify for exemption from all cost sharing (Department of Health, Taiwan). Furthermore, patients may seek care from virtually any of the clinics or hospitals under contract to the NHI, no matter if the provider is for-profit, not-for-profit, or public.[2]

In the first few years of the new program the Bureau of National Health Insurance (BNHI) reimbursed health care providers on a fee-for-service basis. As a result of this, plus the low cost to consumers for virtually unlimited access, government spending on health care increased rapidly: spending on outpatient services, for example, increased 25% between 1996 and 2000. To achieve their second goal of controlling overall health spending, the BNHI reacted quickly to the rapidly rising expenditures by adopting global budgets for each of the major sectors of the health care system, first for dental services in 1998, then traditional outpatient Chinese medical services in 2000, Western-based medical clinics in July 2001, and finally for hospitals, both inpatient and outpatient care, in July 2002.

Taiwan's global budgeting system uses the expenditure cap approach. Before the start of each fiscal year the NHI Expenditure Committee discusses the national budget for each major health care category (dental services, traditional Chinese medical care, clinics, and hospital services) with the BNHI and with representatives of health providers. Once the committee sets the overall national budget for a category, that budget is divided among six health care regions, with the share of each region determined by a combination of historical expenditure levels and risk adjustments. Each region then has its own subsidiary NHI Expenditure Committee to administer their budget for each health care category.

The Global Budget System and Providers' Incentive to Prescribe Drugs

The particular global budget system adopted in Taiwan affects the incentive of hospital physicians to prescribe drugs. Let the global budget for a region's hospital sector be B. Because B is a fixed expenditure level set for the region

before the start of the fiscal year, payments to individual providers must be adjusted according to the overall quantity of services provided. For instance, suppose Hospital i supplies q_i service units during the fiscal year. The price that each hospital receives in reimbursement for each unit of service it provides is:

$$p = B/Q$$

where $Q = \Sigma q_i$ is the *total* number of service units provided by *all* hospitals in the region during the fiscal year. The value p, known as the point value, fluctuates with the volume of service units supplied so that reimbursements do not exceed the fixed budget B. Specifically, if the number of service units supplied exceeds the amount expected when the budget was determined, the point value will be less than one. Thus, when making supply decisions providers know their region's annual hospital budget, and they know the number of service units associated with supplying specific medical services and thus the *quantity* of service units that they are supplying, but they do not know the ex post point value at which service units will be reimbursed: providers must make supply decisions while uncertain of the final point value.

In this situation individual hospitals have an incentive to increase their income by increasing the number of service units they generate (either by increasing the volume of patient visits or the intensity of treatment during a visit). Chen, Laditka, Laditka, and Xirasagar (2007) found significant increases in the number of discretionary, high-volume hospitalizations among many classes of patients after the imposition of global budgets in Taiwan, suggesting that hospitals did respond by attempting to increase their quantity of services. Collectively, however, hospitals will find that as they all increase the amount of service they provide, the point value will float downward. In fact, the average point value across all regions, which was first calculated in the second half of 2002 at approximately .96, decreased to .95 in 2003, then fell to .90 for 2004 and 2005, before rising again to .94 in 2006 (BNIH, 2009), suggesting that in every year hospitals have provided more service units than expected.

However, the global budget scheme for hospitals treats reimbursements for drug prescriptions differently from reimbursements for other health services. Expenditures for drugs (D) are removed from the budget *before* the ex post point value is calculated, so that the point value is:

$$p = (B - D)/Q$$

a practice known as the Pharmaceutical Benefit Scheme (PBS) (NHI, *Global Budget Q&A Manual*). Hospitals thus have an incentive to spend

more on drug treatments so as to avoid the uncertain return associated with services reimbursed by the usually discounted point value. Further, the certain profit margin from drug expenditures is higher than that of the other medical services (Lee, Yang, Huang, Liu, & Chen, 2006).[3] As might be expected, from 1996 to 2003 drug reimbursement grew 50%, from 62.2 billion Taiwan new dollars ($NT) to $NT 94.5 billion, and reimbursements for drugs as a percentage of total health expenditures are significantly higher in Taiwan than in other countries.[4]

The BNHI has adopted several strategies to contain drug expenditures by lowering drug prices.[5] Nevertheless, drug expenditures are still reimbursed at cost before the remaining portion of the budget is divided to determine the floating point value used to reimburse other medical services. It thus remains the case that the removal of drug reimbursements from the global budget creates two potential sources of profit for hospitals, one for drug expenditures that is certain and relatively high, and one for all other expenditures that is uncertain and lower. Hospitals therefore have an incentive to increase use of drugs so as to increase profits from the certain source. It is the hypothesis of this chapter that hospitals in Taiwan have responded to the incentives built into the global budget scheme by increasing prescriptions written for their patients.

METHODOLOGY AND SPECIFICATION

Previous studies of the impact of the PBS on drug prescriptions have looked at drug prescriptions before and after the implementation of the global budget. For instance, in a study of prescriptions for patients with hypertension or diabetes, Chou et al. (2008) found that hospital physicians increased prescriptions, particularly for diabetes patients, after the adoption of global budgeting. However, making before-and-after comparisons may be misleading because of the strategies that the BNHI adopted to control drug prices: such comparisons do not take changes in drug prices into account. Moreover, the BNHI increased its monitoring of utilization, including developing drug utilization guidelines, auditing more claims, and instituting provider profiling (comparing the costs and prescribing patterns among peer providers) and utilization review. These monitoring efforts may also have reduced the impact of the global budget.

Consequently, we use difference-in-differences to isolate the effect of the budget system on the use of drugs. We assume that the effect of the global budget on drug-prescribing decisions varies with the extent that drugs are used

for treating different types of illnesses, and that therefore doctors in different departments should have different responses to the policy. We thus separate hospital departments into treatment and control groups based on the importance of drugs in the care they provide, and estimate the following specification:

$$\begin{aligned} Y_{j,h,t} = {} & \alpha + \beta_1 T_j + \beta_2 GB_t + \beta_3 (T_j * GB_t) \\ & + \beta_4 D_{j,t} + \gamma_j + \beta_5 H_h + \delta + \tau + \varepsilon_{j,h,t} \end{aligned}$$

where j is hospital departments, h the hospitals, and t the months. The dependent variable is the natural log of average drug expenditure per case in department j of hospital h in month t over the years 1999–2006.[6] Since we are interested in changes in the propensity of doctors in different departments to prescribe drugs, we wanted to reduce heterogeneity in expenditures related to other aspects of patient care, and to do so we restricted the sample of cases used to calculate the expenditure variable.

We first eliminated all records for inpatients. The case-mix of inpatient admissions is quite diverse and consequently the average expenditure per inpatient admission is more likely to be affected by extreme values. In addition, inpatient care involves extensive use of expensive equipment. By comparison, drugs are the principal method for treating outpatients. Finally, and importantly, although Taiwan's NHI is noted for its generous coverage, it may not cover the most advanced medical treatment, especially for inpatient care. The inability to track the total health expenditures for such cases could bias our estimates on the impact created by financial incentives associated with global budgeting.

Having restricted our sample to records of outpatient care, we made some additional eliminations: (1) patients treated at local clinics, because local clinics are reimbursed for drug use in a different system, (2) patients that paid a zero co-payment, to avoid possible bias, (3) patients receiving dialysis treatment and surgeries performed at outpatient visits, because these are quite expensive and likely to affect the average expenditures of a hospital substantially, and (4) outpatient records for dental care and for traditional Chinese medical treatments, as both represent very different patterns of care and drug use from the outpatient cases included in the sample.

After our eliminations, the outpatient records we used to calculate drug expenditures are principally those of patients that did not suffer from major illnesses and that did not require repeated or expensive non-drug care (e.g., dialysis, surgery, or care for TB). We assigned each of these remaining cases to a hospital department, and calculated the department's average expenditure per case each month.

The variable T identifies the treatment group. We identify the treatment group by calculating for each department a drug ratio: the average drug expenditure per case as a fraction of total health care expenditure per case for patients treated in that department in a period before global budgeting was instituted (January 1999–June 2002). We then sort the departments into a control group, those departments that use relatively few drugs in their care of these patients and are thus much less likely to respond to the incentives created by the PBS, and a treatment group of departments that rely on drugs more heavily in their treatments (see Table 1).

The variable T equals one if the department has a high drug ratio and is thus a part of the treatment group, and it equals zero if the department is part of the control group of departments with lower drug ratios. We expect the coefficient of this variable to be positive, because departments with higher drug ratios should prescribe relatively greater amounts of drugs each month than the control group, ceteris paribus.

Table 1. Treatment and Control Groups[a].

Treatment Group		Control Group	
Department	Drug Ratio[b]	Department	Drug Ratio[b]
Renal medicine	0.696	Blood cancer	0.513
Cardiology	0.674	Combination of three small departments with medium drug ratios	0.501
Endocrinology	0.667	Orthopedics	0.474
Thorax internal	0.666	Gastrointestinal surgery	0.466
Cardiovascular surgery	0.650	Thoracic surgery	0.456
Psychiatrics	0.649	General	0.447
Division of infectious diseases	0.648	Ear, nose, and throat	0.440
Neurology	0.646	Pediatrics	0.415
Rheumatoid immune branch	0.630	Obstetrics and gynecology	0.412
Family medicine	0.608	Rectal surgery	0.395
Internal medicine	0.601	Combination of three small departments with low drug ratios	0.395
Gastroenterology	0.587	Surgery	0.383
Neurosurgery	0.570	Radiation oncology	0.365
Dermatology	0.560	Ophthalmology	0.353
Urology	0.543	Pediatric surgery	0.160

[a]The average number of departments in a hospital is 7.76, with a standard deviation of 7.577 and a range of 1–33. Treatment and control groups are identified using average department drug ratios for the period 1999–June 2002.

[b]Drug ratios are average for the period 1999–June 2002.

The variable GB is a dummy variable that equals 0 for months before July 2002, the month that global budgeting began at hospitals, and equals 1 for months afterwards. We expect that the global budgeting system with the drug expenditure offset will be associated with greater drug expenditures, ceteris paribus, so the coefficient of this variable should be positive.

We form our key variable of interest by interacting the treatment group dummy with the global budget dummy to examine the behavior of those departments that prescribed drugs more heavily after global budgeting began. Since these departments were already prone to use more drugs in their medical care, we expect that they may have more scope to respond to the global budgeting system compared to the control group and therefore expect the coefficient of this variable to be positive.

The variable D represents the percentage of drug prescriptions written for chronic patients as opposed to the other patients in our sample, for a department in a month. We include this variable to control for differences in the ability of physicians to alter prescription behavior that may be represented by these two types of patients. We also include a set of department fixed effects, γ_j.

The vector H represents variables included to control for variation in hospital characteristics that might affect prescribing behavior. We use two approaches to control for hospital characteristics. We first estimate the specification with 11 variables to control for the following hospital characteristics: type of hospital, hospital accreditation level, ownership type, and hospital size. We use five dummies to control for six different hospital types: ordinary hospitals (community hospitals that provide a limited set of general services), specialty hospitals (e.g., obstetrics hospitals), psychiatric hospitals, special hospitals (e.g., alcohol or drug abuse treatment), and hospitals for chronic care (e.g., TB). The base group is general hospitals (hospitals that offer a broad range of services).

Three dummy variables are constructed to control for different hospital accreditation levels: regional hospitals (minor teaching hospitals), accredited community hospitals, and non-accredited community hospitals. The base group is medical centers (major teaching hospitals).

We also include two dummies to control for hospital ownership type. Taiwan law classifies hospital owners into three types: public, private-not-for-profit, and for-profit (Lien, Chou, & Liu, 2008). The base group is public hospitals, which are hospitals managed by either the government, by public enterprises, or by public universities. We include a dummy for private not-for-profit hospitals (NFP), which may be owned by private universities or by charitable groups or groups funding medical research, and a dummy

for for-profit hospitals (FP), which are owned and operated by physicians. Finally, we include the number of beds as a measure of hospital size.

As an alternative to modeling hospital characteristics, we use fixed effects, replacing all variables representing hospital characteristics with one for each hospital.

In all specifications we include five regional dummies (δ) to control for the health service region in which the hospital is located. Hospitals located in Region One form the base group.

Finally, we include year dummies (τ) to control for time-related factors that may affect prescription behavior, including: the different drug cost containment strategies implemented by the National Health Insurance Bureau of Taiwan, the introduction of new drugs, which are typically more expensive, and advances in medical technology. In addition, however, we re-estimated the specification several times, omitting different years of the sample. First, we dropped observations from 2002 to 2003, 2002 because that was the year that hospitals switched to the global budget systems, and 2003 because the outbreak of Severe Acute Respiratory Syndrome (SARS) that year may have affected peoples' willingness to go to the hospital and prescribing decisions. We also estimated the specification using just the year before global budgeting and the year after (2001, 2004, again excluding 2003), and again using just the two years before global budgeting (2000 and 2001) and the two years after (2004 and 2005, again excluding 2003).

Table 2 gives descriptive statistics for the variables used in the specification.

DATA

The data are from two sources, both from the National Health Insurance Database (NHID) that covers health utilization by all NHI enrollees in Taiwan. Our principal data are derived from the longitudinal claims of a random sample of one million NHI enrollees, approximately 5% of the 20 million people in Taiwan, between 1999 and 2006.[7] Each claim includes diagnoses of diseases, dates of admission and discharge (for inpatient care) and treatment (for outpatient care), the department that provided the services, as well as a unique identifier for the health provider. More importantly, the claim contains a detailed description of the hospital's claim for reimbursement, including a separate identification of the requested reimbursement for expenditures on drugs,[8] which allows us to identify the contribution of drug expenses to the total expenditure for each outpatient treated at every hospital.

We use the hospital identifier to merge these outpatient claim files with hospital basic files from NHID in the same period to obtain a hospital's

Table 2. Sample Statistics[a].

	Whole Sample		Treatment Group[b]		Control Group[b]	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Dependent variable						
Mean of drug expenditure (NT$)	431.44	730.12	649.93	487.12	321.12	803.84
log(Mean of drug amount)	5.60	1.06	6.17	0.91	5.31	1.01
Explanatory variables						
Hospital type (%)						
General hospital	59.8%	0.49	62.7%	0.48	58.3%	0.49
Ordinary hospital	36.5%	0.48	33.5%	0.47	38.1%	0.49
Specialty hospital	2.0%	0.14	1.2%	0.11	2.4%	0.15
Psychiatric hospital	1.1%	0.10	1.7%	0.13	0.7%	0.09
Special hospital	0.1%	0.04	0.2%	0.04	0.1%	0.03
Chronic hospital	0.5%	0.07	0.6%	0.08	0.4%	0.06
Hospital accreditation (%)						
Medical center	11.7%	0.32	11.9%	0.32	11.6%	0.32
Regional hospital	33.3%	0.47	37.3%	0.48	31.2%	0.46
County hospital	54.5%	0.50	50.4%	0.50	56.5%	0.50
Clinic hospital	0.6%	0.07	0.4%	0.06	0.7%	0.08
Hospital ownership (%)						
For-profit	41.4%	0.49	38.8%	0.49	42.7%	0.49
Non-for-profit	30.3%	0.46	33.5%	0.47	28.8%	0.45
Public	28.2%	0.45	27.8%	0.45	28.5%	0.45
Health service region (%)						
Region 1	27.3%	0.45	26.9%	0.44	27.5%	0.45
Region 2	14.1%	0.35	15.1%	0.36	13.5%	0.34
Region 3	21.5%	0.41	22.1%	0.42	21.2%	0.41
Region 4	15.1%	0.36	15.1%	0.36	15.2%	0.36
Region 5	17.9%	0.38	16.7%	0.37	18.5%	0.39
Region 6	4.1%	0.20	4.1%	0.20	4.1%	0.20
Hospital size						
Number of beds	473.8	559.6	514.1	566.7	453.5	554.9
Case type (%)						
Chronic cases	86.5%	0.34	94.9%	0.22	82.2%	0.38
Non-chronic cases	13.5%	0.34	5.1%	0.22	17.8%	0.38
Sample size	344,232		115,490		228,742	

[a]The number of hospitals decreased during the period of this study, from 634 hospitals in 1999 to 523 in 2006 (BNIH, 2007).

[b]Treatment and control groups are identified using average department drug ratios for the period 1999–June 2002. See Table 1.

accreditation level, ownership status, and its zip-code, which we use to identify its region. After eliminating some observations with missing data, the final sample size is 344,232 observations of average monthly hospital-department drug expenditure over the period 1999–2006.

RESULTS

We use OLS to estimate the specification, and cluster the standard errors by hospital.

Table 3 shows the basic estimation results. Columns (1) and (2) represent results using all years of the data: column (1) includes variables for hospital characteristics and column (2) includes hospital fixed effects instead. Columns (3) and (4) repeat the estimations of columns (1) and (2) with the years 2002 and 2003 omitted.

Inspection of the key variable, the interaction of the dummy for the global budgeting period and the treatment dummy, shows that average drug expenditures by departments in the treatment group were significantly higher, by 15–16%, after the imposition of global budgeting. The result is somewhat stronger with the years 2002 and 2003 omitted.

The results also show that average drug expenditure by treatment group departments was significantly higher than expenditures by the control group departments, as would be expected. Interestingly, the global budget dummy shows that, after controlling for department, hospital, regional, and annual effects, average department drug expenditures were significantly *lower* after the imposition of global budgets, suggesting that the steps taken by the Taiwanese Department of Health to counteract the incentives created by the PBS may have been effective.

Departments that wrote a higher percentage of prescriptions for chronic patients had significantly higher drug expenditures, ceteris paribus. All hospital types had lower average drug expenditures than the base group (general hospitals that offer a broad range of services), and hospitals with higher levels of accreditation were systematically more likely to make greater expenditures on drugs. These patterns likely reflect the greater breadth and specialization of care in the two base groups: the patients they treat may require more sophisticated and more expensive drug treatments. Interestingly, departments in FP hospitals had significantly lower claims for drug reimbursement. We pursue the issue of owner-type effects further below.

Table 4 shows the estimation of the basic specification (with and without hospital fixed effects) looking at only the one-year before and after time

Table 3. OLS Estimation Explaining the Log of Average Department Expenditure per Case on Drugs.

	1999–2006		2002 and 2003 Omitted	
	(1)	(2)	(3)	(4)
*GB*treatment dummy*	0.155***	0.157***	0.189***	0.189***
	[0.0134]	[0.00413]	[0.0165]	[0.00476]
Treatment dummy	0.366***	0.510***	0.400***	0.322***
	[0.0737]	[0.0167]	[0.0769]	[0.0184]
GB	−0.0741***	−0.0728***	−0.275***	−0.240***
	[0.00979]	[0.00607]	[0.0238]	[0.00511]
Percentage of chronic cases	1.371***	1.328***	1.363***	1.319***
	[0.0377]	[0.00428]	[0.0374]	[0.00497]
Hospital type				
Ordinary hospital	−0.103***		−0.0972***	
	[0.0274]		[0.0271]	
Specialty hospital	−0.223***		−0.232***	
	[0.0652]		[0.0712]	
Psychiatric hospital	−0.0417		−0.0603	
	[0.0839]		[0.0800]	
Special hospital	−0.674***		0.138	
	[0.0824]		[0.162]	
Chronic hospital	−0.281**		−0.260**	
	[0.128]		[0.108]	
Hospital accreditation				
Regional hospital	−0.110*		−0.0899	
	[0.0628]		[0.0579]	
County hospital	−0.220***		−0.190***	
	[0.0728]		[0.0670]	
Clinic hospital	−0.0866		−0.0766	
	[0.163]		[0.156]	
Hospital ownership				
NFP	0.0218		0.0303	
	[0.0319]		[0.0320]	
FP	−0.0827***		−0.0726**	
	[0.0296]		[0.0295]	
Number of beds	2.87e-05		4.52e-05*	
	[2.85e-05]		[2.52e-05]	
Constant	4.894***	4.669***	4.832***	4.644***
	[0.0964]	[0.0397]	[0.0956]	[0.0405]
Observations	344232	344232	257102	257102
R^2	0.634	0.696	0.632	0.694

Notes: Standard errors are clustered by hospital and are reported in brackets. All regressions include department, region, and year fixed effects. Regressions (2) and (4) also include hospital fixed effects.

***$p<.01$, **$p<.05$, *$p<.1$.

Table 4. OLS Estimation Explaining the Log of Average Department Expenditure per Case on Drugs for Selected Years.

	Before: 2001 & After: 2004		Before:2000–2001 & After: 2004–2005	
	(1)	(2)	(3)	(4)
*GB*treatment dummy*	0.0700***	0.0719***	0.127***	0.128***
	[0.0160]	[0.00782]	[0.0163]	[0.00570]
Treatment dummy	0.340***	0.262***	0.656***	0.343***
	[0.0848]	[0.0319]	[0.0875]	[0.0227]
GB	−0.0219	−0.0115*	−0.0542***	−0.0874***
	[0.0168]	[0.00599]	[0.0176]	[0.00524]
Percentage of chronic cases	1.357***	1.318***	1.360***	1.328***
	[0.0426]	[0.00843]	[0.0405]	[0.00604]
Hospital type				
Ordinary hospital	−0.107***		−0.0986***	
	[0.0300]		[0.0281]	
Specialty hospital	−0.258***		−0.255***	
	[0.0730]		[0.0779]	
Psychiatric hospital	−0.0764		−0.0809	
	[0.0977]		[0.0858]	
Special hospital	0		0.868***	
	[0]		[0.0753]	
Chronic hospital	−0.350***		−0.313***	
	[0.131]		[0.106]	
Hospital accreditation				
Regional hospital	−0.0750		−0.0801	
	[0.0751]		[0.0667]	
County hospital	−0.175**		−0.175**	
	[0.0866]		[0.0765]	
Clinic hospital	0.0350		−0.0242	
	[0.178]		[0.163]	
Hospital ownership				
NFP	0.0172		0.0246	
	[0.0361]		[0.0338]	
FP	−0.118***		−0.0886***	
	[0.0318]		[0.0302]	
Number of beds	3.68e-05		4.59e-05*	
	[3.43e-05]		[2.74e-05]	
Constant	4.785***	4.659***	4.704***	4.569***
	[0.113]	[0.0765]	[0.109]	[0.0501]
Observations	87712	87712	173408	173408
R^2	0.639	0.716	0.635	0.703

Notes: Standard errors are clustered by hospitals and are reported in brackets. All regressions include hospital department dummies and year dummies. Regressions (2) and (4) also include hospital fixed effects.

***$p<.01$, **$p<.05$, *$p<.1$.

period (columns 1 and 2), and the two-year before and after time periods (columns 3 and 4), again omitting 2003. The results show that the effect of the PBS on prescribing behavior appears to grow as physicians and hospitals have more time to adjust to the new reimbursement system.

We investigated further the impact of owner-type by re-estimating the basic specification, this time with the base group as FP hospitals. We interact each owner type, NFP and public (GOV), with the key variable, the interaction between the global budget dummy GB and the treatment dummy T, as well as with the variables GB and T individually.

Table 5 shows the results for the entire sample (column 1), for the sample omitting 2002 and 2003 (column 2), for the one year window (column 3) and for the two year window (column 4).

The results for the treatment dummy T, the global budget dummy GB, and the interaction of the two continue to show that, overall, the treatment group departments spent more on drug treatments, that average expenditure of all departments fell with the imposition of global budgeting, and that treatment group departments spent more on drugs after global budgeting began. However, the two coefficients for the interactions of T, GB, and owner type show that treatment departments in NFP and public hospitals spent significantly less on drugs, approximately 12–13% less, than departments in FP hospitals, after global budgeting began.

With all interactions included, the dummy variables for owner type now show that as a group both NFP and public hospital departments spent less on prescriptions than FP hospital departments, but the coefficients on the two variables interacting ownership type with the treatment dummy show that treatment departments in NFP and public hospitals spent more than treatment departments in FP hospitals over the entire period. The coefficients on variables interacting ownership type with the global budget dummy show that both NFP and GOV hospital departments increased their expenditure on drug treatments more than FP hospital departments.

CONCLUSION

In this chapter we study drug prescribing behavior by hospital departments before and after global budgeting with the PBS offset was instituted. Our hypothesis was that providers would respond to the incentives created by the new system by increasing their prescriptions, and thus increasing the share of drug expenditure in the total health care expenditure on each case. We find some evidence to support our hypothesis: departments in the

Table 5. OLS Estimation Explaining the Log of Average Department Expenditure per Case on Drugs with Owner-Type Interactions.

	1999–2006	2002 and 2003 Omitted	2001 & 2004	2000–2001 & 2004–2005
	(1)	(2)	(3)	(4)
NFP∗GB∗ treatment dummy	−0.129***	−0.166***	−0.100***	−0.136***
	[0.0108]	[0.0123]	[0.0209]	[0.0149]
GOV∗GB∗ treatment dummy	−0.138***	−0.171***	−0.116***	−0.157***
	[0.0108]	[0.0124]	[0.0210]	[0.0151]
GB∗ treatment dummy	0.227***	0.281***	0.128***	0.207***
	[0.00689]	[0.00792]	[0.0134]	[0.00958]
Treatment dummy	0.257***	0.290***	0.227***	0.545***
	[0.0164]	[0.0187]	[0.0323]	[0.0243]
GB	−0.144***	−0.358***	−0.0876***	−0.134***
	[0.00758]	[0.00680]	[0.00972]	[0.00759]
NFP∗ treatment dummy	0.246***	0.253***	0.260***	0.250***
	[0.00849]	[0.00927]	[0.0155]	[0.0111]
GOV∗ treatment dummy	0.176***	0.180***	0.170***	0.178***
	[0.00835]	[0.00910]	[0.0153]	[0.0110]
NFP∗GB	0.144***	0.181***	0.128***	0.156***
	[0.00806]	[0.00921]	[0.0157]	[0.0112]
GOV∗ GB	0.111***	0.126***	0.112***	0.136***
	[0.00791]	[0.00913]	[0.0155]	[0.0111]
Percentage of chronic cases	1.377***	1.368***	1.365***	1.366***
	[0.00415]	[0.00479]	[0.00820]	[0.00584]
Hospital type				
Ordinary hospital	−0.107***	−0.101***	−0.111***	−0.102***
	[0.00324]	[0.00374]	[0.00646]	[0.00459]
Specialty hospital	−0.236***	−0.245***	−0.271***	−0.269***
	[0.00829]	[0.00940]	[0.0163]	[0.0117]
Psychiatric hospital	−0.0316***	−0.0499***	−0.0656***	−0.0708***
	[0.0114]	[0.0132]	[0.0217]	[0.0158]
Special hospital	−0.687***	0.106	0	0.846***
	[0.0297]	[0.103]	[0]	[0.193]
Chronic hospital	−0.276***	−0.254***	−0.343***	−0.307***
	[0.0159]	[0.0183]	[0.0336]	[0.0234]
Hospital accreditation				
Regional hospital	−0.110***	−0.0896***	−0.0769***	−0.0820***
	[0.00511]	[0.00581]	[0.0108]	[0.00724]
County hospital	−0.219***	−0.190***	−0.177***	−0.178***
	[0.00631]	[0.00714]	[0.0133]	[0.00891]
Clinic hospital	−0.0943***	−0.0849***	0.0227	−0.0363
	[0.0161]	[0.0179]	[0.0335]	[0.0223]
Hospital ownership				
NFP	−0.0769***	−0.0860***	−0.0502***	−0.0704***
	[0.00656]	[0.00717]	[0.0122]	[0.00870]

Table 5. (*Continued*)

	1999–2006	2002 and 2003 Omitted	2001 & 2004	2000–2001 & 2004–2005
	(1)	(2)	(3)	(4)
FP	−0.0329***	−0.0402***	0.000239	−0.0327***
	[0.00624]	[0.00681]	[0.0116]	[0.00828]
Number of beds	2.77e-05***	4.41e-05***	3.41e-05***	4.31e-05***
	[3.53e-06]	[3.97e-06]	[7.72e-06]	[4.95e-06]
Constant	4.858***	4.806***	4.716***	4.669***
	[0.0146]	[0.0165]	[0.0289]	[0.0206]
Observations	344232	257102	87712	173408
R^2	0.635	0.634	0.641	0.637

Notes: Standard errors in brackets. All estimations include department, region, and year fixed effects.
***$p<.01$, **$p<.05$, *$p<.1$.

treatment group increased their average monthly drug expenditure per case after the global budget system was introduced in 2002. We also found this response to be more pronounced in treatment departments in FP hospitals as opposed to those in NFP or public hospitals.

NOTES

1. For example, Naito (2006) finds that the resource intensity of treatments chosen for patients with end-stage renal disease in Japan may be affected by the movement from fee-for-service to global-budget type reimbursement systems. Sepehri, Chernomas, and Akram-Lodhi (2005) find that in Vietnam the gradual growth of revenues from patients with private insurance, as opposed to revenues from a governmental global budget, has introduced differences in treatment patterns for insured vs. uninsured patients. Coyte et al. (1994) and Hamilton, Ho, and Goldman (2000) compare waiting times for surgery in Canada to waiting times in the United States. However, see also Feldman and Lobo (1997) who examine the theoretical basis for expecting health systems using global budget to experience excess demand.

2. The NHI has contracts with approximately 97% of hospitals and 93% of clinics (http://www.doh.gov.tw/statistic).

3. Lee et al. (2006) indicates that the profit rate earned on prescription drugs, in the range 5–40%, is greater than the profit earned from providing other medical services, which is less than 10%.

4. During the period 1997–2005, drugs represented 21–25% of overall national expenditures for health care in Taiwan compared to18.4–20.6% in Japan, 18–20.9% in France, 12.9–14.6% in Germany, and 9.7–12.3% in the United States (NHI Statistics).

5. Their strategies to control prices include: (1) adjusting drug prices based on comparisons to prices of existing drugs (inter-brand comparisons) or to prices found in market price and volume surveys; (2) delegating the financial responsibility to the regional bureaus; (3) instituting a co-pay for outpatient drugs; (4) reducing the flat daily rate used to reimburse drug prescriptions by clinics; and (5) pricing by generic group, that is, reference pricing based on the similarity of the active ingredients of drugs (Lee et al., 2006).

6. Each case represents one patient visit. We also estimated all specifications with the log of the number of prescriptions written each month by each hospital department instead of the expenditure. As the results were very similar to those reported here, we do not report them. These results are available on request from the authors.

7. The original random sample of one million NHI enrollees was drawn from the 2005 claims data. We then extracted those patients' complete claims records between 1997 and 2006.

8. Because few adjustments were made to the charged payments, the actual reimbursement that NHI paid was very close to the charged expense.

ACKNOWLEDGMENTS

We are grateful to the National Health Research Institute for providing the data. Support from the National Science Council (NSC 97-2410-H-004-009-MY2) for Hsien-Ming Lien is greatly appreciated. The usual disclaimers apply.

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