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Philippine Institute for Development Studies

Analysis of Supply and Market for Health Care Facilities

Ma. Socorro Zingapan

DISCUSSION PAPER SERIES NO. 95-10

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Analysis of Supply and Market for Health Care Facilities: Final Report

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Baseline Studies for Health Care Financing Reforms Project

Analysis of Supply and Market for Health Care Facilities : Final Report

Executive Summary

The final report of the project *Analysis of Supply and Market for Health Care Facilities* (PIDS Project No. DOH/91-92/07) is comprised of two studies contained in this volume, namely "Analysis of Supply and Market for Hospital Services, " and "Hospital Investment Patterns: A Baseline Study."

The first study deals primarily with the following issues : does insurance (specifically, Medicare) have an inflationary effect on government and private hospital fees? To what extent has this affected the utilization of hospital services? What other factors determine the demand and supply for hospital services?

The second study is more descriptive than analytical, presenting a profile of the types of hospital investment by ownership (public and private) and type of hospital care (primary, secondary, and tertiary), their average magnitude and how these were financed. It also attempts to examine the determinants of the following aspects of hospital investment behavior: (a) likelihood of a hospital to invest; (b) level of capital expenditures; (c) hospital bed size; and (d) likelihood of acquiring a short list of equipment that includes the most basic (X-ray and ECG machine) and the relatively advanced (ultrasound, MRI and CT Scan).

Why the focus on hospitals? Hospitals are perhaps the most important institutional recipient of the country's financial resources for health. Prior to the devolution of municipal, district and provincial hospitals to local government units, at least sixty percent of the Department of Health's annual budgetary allocation were appropriated for hospital services. The allocation of insurance funds has similarly favored these services. Ninety-percent of all licensed government and private hospitals which comprise the Medicare-affiliated segment of the sector receive about sixty-seven percent of the annual health expenditures paid for by Medicare (PMCC Survey,1989). Meanwhile, households annually spend fifteen percent of their out-of-pocket medical expenditures in hospitals (FIES, 1985). Assuming that allocations of the private health insurance system for medical care were spent for hospitalization only, these figures suggest that approximately forty-two percent of all health resources in the country are coursed to the hospital sector annually.

Analysis of Supply and Market for Hospital Services: main issues and results

1. *Did insurance, specifically Medicare have an inflationary impact on public and private hospital fees?* The impact of Medicare on

hospital fees is found to depend on the amount of reimbursement or support value, and on the enrollment or coverage rate of the hospital in-patients. A percent increase in the coverage rate is occasioned by an increase in the average in-patient fee of P98.21 in the private sector, while this brought a slight reduction of P4.72 in the government sector. Seemingly, a higher coverage rate bolsters the ability of private facilities to earn larger profit-maximizing mark-ups; in the government sector, this in effect allows government patients to enjoy greater subsidy.

Higher reimbursements to the hospital per insured patient also had an inflationary effect on private sector prices but a deflationary effect on government prices. The inflationary effect on private hospital services is due to two sources : (a) an increase in the marginal cost brought about by a shift in the demand curve; and (b) an increase in the mark-up due to the change in the slope of the demand curve. Almost half of the price increase for IP care induced by higher insurance reimbursements in the private sector is attributable to increases in the mark-ups. The upward shift in IP care also pushes marginal cost, and consequently the average fee by 76 cents for every peso hike in the support value. In the government sector, the deflationary impact is due to lower marginal cost and higher subsidy per discharge.

2. *To what extent has Medicare influenced utilization of hospital services?* The insurance variables (support value per insured patient) appeared to influence the pattern of both government and private hospital discharges, but at opposite directions. While a percentage increase in the support value pushes private discharges by .36 percent, this pulls down government discharges by .33 percent. Possibly, an increase in the support value enables insured patients in a private hospital to purchase more diagnostics and medicine since they are now less sensitive to prices. This, in turn, could facilitate shorter lengths of stay, consequently allowing the hospital to treat a greater number of cases. The dampening effect of insurance support on government facilities on the other hand will be expected if this allows the insured to purchase longer days of stay. Though they may also be less sensitive to the prices of diagnostics and drugs, perhaps the absence or shortage of these services in government facilities does not allow them the opportunity to avail shorter lenghts of stay in the same way as the private hospital users.

3. *Findings on other factors influencing the supply/marginal cost of hospital services.* The marginal cost of in-patient care in the public sector seems to vary positively with in-patient load, and out-patient load but is found invariant with bed capacity and wage levels. On the other hand, marginal cost of an IP care in the private sector is sensitive not only to in-patient load but more so to the wage level and bed capacity.

As regards out-patient care, marginal cost of a contact in the public sector decreases with the number of contacts, but seems to increase with the number of in-patient discharges. In private

hospitals, econometric estimates in this paper suggest the marginal cost of an OP to be zero. A plausible explanation is that OP departments of private hospitals are used primarily not as treatment centers but as referral points for physicians whose clinics are also located in the same building as the hospital

4. *Findings on other factors influencing demand for hospital services*. Hospital size or bed capacity has the most substantial impact on the volume of discharges. An additional bed in private facilities brings about an increase of .02 percent in total discharges or 31 patients per year. In government facilities, the incremental effect is lower (percentage wise) at .012 percent, but almost the same in terms of the absolute count (33 patients per year).

Size of facility does not seemingly influence the pattern of OP visits in government facilities unlike in the private hospital sector where its effect even exceed the price effect.

Hospital Investment Pattern: A Baseline Study

1. *Private vs. public hospital investment behavior*. While ownership does not seemingly influence the propensity of facilities to incur capital expenditures in a single year, public and private hospitals differ as regards the type of hospital investment in the long-run. Whereas government facilities preferred to have bigger bed capacity as compared to private facilities, the latter are shown to have greater propensity to invest in the relatively advanced technology as exemplified by MRI, CT Scan and ultrasound compared to government facilities.

2. *Determinants of decision to invest*. Three significant determinants of a hospital's decision to invest in the period under study (1991) are found: (a) capacity of existing beds of private facilities in the province; (b) the case mix of the hospital, specifically the ratio of patients who were attended to with surgical procedure; and (c) the number of private financing schemes to which the hospital is affiliated.

For every 100 private hospital beds in the province, the likelihood of a hospital to expand and/or spend for maintenance or replacement investment drops by 2 percent. However, this crowding-out effect is absent if the other providers are government-owned.

The probability of a hospital to spend for capital expenditures increases by 11.67 percent for every accreditation or affiliation with a private insurance scheme.

Hospitals with greater concentration of patients requiring surgery have greater propensities to spend for fixed assets. For every 1 percent share of the surgery unit to the total in-patient load, the hospital increases its likelihood to invest by 1.63 percent.

3. *Determinants of the amount of capital expenditures*. Significant factors found to influence the pattern of spending for equipment and other physical assets across hospitals are as follows:

(a) In-patient fee. A percent change in the prior year's average in-patient fee redounds to only .57 percent increase in hospital capital spending.

(b) Infant mortality rate in the province. An increase in the prior year's provincial IMR by 1 percent induces an increase in capital expenditures of the average hospital by .004 percent.

(c) Case mix. Hospitals with bigger admissions for surgery also came up with larger spending for capital.

(d) Mark-up from Medicare. Higher mark-up rates from Medicare patients are found to correlate positively and significantly with larger spending for capital.

(e) Assets at the beginning of the year. Higher assets prior to investment also inhibit capital spending.

(f) Ownership. Ownership of the facility by the government increases the average facility's capital spending by P546,975.69. This could be traced, among other factors, to (a) monopoly of government's hospital access to direct government subsidy which allows them acquire more capital items ; and (b) better access to tax exemptions which lessens the cost of acquisition.

Analysis of Supply and Market for Hospital Services

ANALYSIS OF SUPPLY AND MARKET FOR HOSPITAL SERVICES

Ma. Socorro V. Zingapan[1]

I. Introduction

A. Background, objectives and rationale

Hospitals are perhaps the most important institutional recipient of the country's financial resources for health. Prior to the devolution of municipal, district and provincial hospitals to local government units, at least sixty percent of the Department of Health's annual budgetary allocation were appropriated for hospital services. The allocation of insurance funds has similarly favored these services. Ninety-percent of all licensed government and private hospitals which comprise the Medicare-affiliated segment of the sector receive about sixty-seven percent of the annual health expenditures paid for by Medicare (PMCC Survey,1989). Meanwhile, households annually spend fifteen percent of their out-of-pocket medical expenditures in hospitals (FIES, 1985). Assuming that allocations of the private health insurance system for medical care were spent for hospitalization only, these figures suggest that approximately forty-two percent of all health resources in the country are coursed to the hospital sector annually.

In this light, attempts toward reforming the mechanisms that would alter the make-up and size of resources for hospital care require an examination of how these would consequently affect their delivery of services for patient care. Hospitals comprise the larger and more complex institutional providers of the country's personal health care needs. Although anecdotal accounts also point to the pervasive role of government and private clinics, available documents (e.g. National Health Survey, DOH, 1987) confirm the expected dominance of hospitals in the delivery of therapeutic and diagnostic services in the country. Government hospitals alone serve at least one out of three households in the country for services which even extend to public health concerns such as family planning and health and nutrition education. Private hospitals also

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[1] The author gratefully acknowledges the research assistance of Charina Tumacder, Alvin Catalan and Maribel Agtarap. The paper also benefitted from the comments of Dr. Orville Solon, Dr. Michael Alba and Dr. Felipe Medalla, all from the UP School of Economics. Responsibility for remaining errors and shortcomings is the author's alone.

serve a similar proportion of total households in the country.[2]

This paper attempts to look into the market for private and government hospital services. Both the cost and demand functions for these services are estimated using cross section data. The parameters from these functions are then drawn to come up with the price function of government and private hospitals. From these estimated functions, the implications of government policies, specifically financing policies, on their pricing decisions and utilization are drawn. Did insurance have an inflationary effect on both private government and private hospital services? If so, to what extent did this affect their utilization? In view of recent discussions regarding the "privatization" of government hospitals -which in a broader perspective refers not only to the takeover of ownership by private agents but extends as well to the application of private sector policies while their ownership remains in government - this paper then hopes to contribute to the discussion on the effects of privatized pricing policies on government hospitals.

B. Organization of the report

The rest of this report consists of five parts. Section II gives a brief, descriptive overview of the hospital market in the country based on secondary data from the Bureau of Licensing and Regulations of the Department of Health and National Statistics Office. Section III discusses a theoretical model of how government and private hospitals determine their in-patient and out-patient fees. Section IV describes the data and estimation procedure for the cost, demand and price functions in this paper. Section V which comprises the major part of this report will focus on the empirical results. Finally, Section VI highlights some implications of the results on the following issues (a): effects on utilization of alternative pricing regimes in the government sector; and (b) effects of third-party schemes on government and private prices and utilization.

[2] It should be pointed out, however, that the National Health Survey (DOH, 1987) lumps private hospitals and private clinics in one categ

II. The Hospital Market in the Philippines : an Overview

This section presents a brief, descriptive backdrop on the hospital market in the country : (a) the pattern of bed supply through the period 1965-1990 and across regions; (b) the ownership structure; (c) organizational profile; (d) mix of service; and (e) profile of patients by payment scheme; and (f) pricing patterns. This piece is based on data culled from from hospital reports of the Bureau of Licensing and Regulations - Department of Health and the National Statistics Office. The DOH hospital statistics pertain only to monitored, licensed hospitals; as such they exclude data on unmonitored licensed and unlicensed hospitals. In view of this, it should be mentioned here that the information forwarded that the information forwarded in this section is understandably limited.

A. Historical growth : 1965-1990

The growth of the hospital sector in the past two and a half decades is characterized by four developments: (a) unsustained improvement in total bed supply; (b) reductions in the average bed capacity of both government and private hospitals; (c) the increasingly active participation of the private sector; and (d) the dominant, albeit, declining role of the government sector.

With regard to changes in total bed supply over the same period, the following trends stand out : (a) relatively large, but highly erratic changes in the bed-population ratio from 1965 to 1971; (b) moderate, but sustained, increases in bed supply from 1972 to 1980; and (c) the decline in recent years, particularly in 1986-1990 (see Table 1).

The first period witnessed a general increase in bed supply as the bed-to-population ratio improved remarkably from 1:1034 in 1965 to 1:685 in 1970. The sustained improvement recorded from 1972 to 1980 seems to be an offshoot of the introduction of Medicare at the onset of the period. It is during this period that the country achieved the highest levels of bed supply ever in the past two and a half decades. Thereafter (1981-1990) the same supply indicator has slowly dipped, reaching 1:792 in 1990. It may be pointed out that the latter period was also occasioned by the further deterioration of the Medicare support value in real terms as well as the macroeconomic crisis in the early to mid-80s that also saw the capacities of other services and manufacturing sectors on a downswing.

As of 1990, the sector was comprised of 1,686 hospitals, a magnitude that represents a four-fold increase over that recorded two and a half decades ago. However, in terms of the number of

Table 1
Number of Hospitals, Beds and Beds/Population Ratios: 1965 -1990

Year	Population	Growth Rate	GOVERNMENT			PRIVATE			TOTAL			Hospital Population Ratio	Bed Population Ratio
			Hosp	Beds	Growth Rate	Hosp	Beds	Growth Rate	Hosp	Beds	Growth Rate		
1990	61,480,180	2.25	566	40,791	(14.34)	1,120	36,838	(4.09)	1,686	77,629	(9.48)	1:36,465	1:792
1989	60,096,988	2.29	564	46,639	(0.37)	1,132	38,346	(3.55)	1,696	84,985	(1.80)	1:35,435	1:707
1988	58,721,307	2.32	580	46,811	0.61	1,186	39,706	(3.69)	1,766	86,517	(1.36)	1:33,251	1:679
1987	57,356,042	2.36	590	46,525	(5.12)	1,209	41,172	2.20	1,799	87,697	(1.68)	1:31,882	1:654
1986	56,004,130	2.39	617	48,906	1.04	1,229	40,265	(3.35)	1,846	89,171	(0.94)	1:30,338	1:628
1985	54,668,332	2.17	624	48,398	3.13	1,190	41,613	(2.60)	1,814	90,011	0.48	1:30,137	1:607
1984	53,483,070	2.69	546	46,881	1.68	1,235	42,694	10.88	1,781	89,575	6.06	1:30,030	1:597
1983	52,042,273	2.98	524	46,095	(4.56)	1,179	38,050	(5.26)	1,703	84,145	(4.88)	1:30,559	1:618
1982	50,489,721	2.69	519	48,199	(3.69)	1,194	40,051	18.42	1,713	88,250	6.34	1:29,474	1:572
1981	49,133,553	0.49	490	49,978	0.54	1,097	32,675	1.21	1,587	82,653	0.81	1:30,960	1:594
1980	48,890,707	2.41	488	49,708	6.74	1,112	32,279	(16.98)	1,600	81,987	(2.60)	1:30,557	1:596
1979	47,712,017	2.39	439	46,358	1.81	1,061	37,760	4.32	1,500	84,118	2.94	1:31,808	1:567
1978	46,573,327	2.44	376	45,517	1.57	837	36,129	5.62	1,213	81,646	3.36	1:38,395	1:570
1977	45,434,637	2.51	372	44,802	0.61	777	34,099	8.93	1,149	78,901	4.21	1:39,543	1:576
1976	44,295,947	2.62	367	44,527	5.97	671	31,053	9.03	1,038	75,580	7.23	1:42,674	1:586
1975	43,137,257	3.62	364	41,867	5.11	611	28,248	9.47	975	70,115	6.87	1:44,243	1:615
1974	41,573,745	3.11	326	39,726	30.04	570	25,574	7.11	896	65,300	21.06	1:46,399	1:637
1973	40,280,000	2.86	291	27,791	25.76	514	23,755	6.80	805	51,546	17.03	1:50,037	1:781
1972	39,127,758	2.88	280	20,631	7.68	443	22,139	14.73	723	42,770	11.33	1:54,119	1:915
1971	38,000,332	2.63	244	19,046	(74.30)	423	18,879	(11.59)	667	37,925	(43.09)	1:56,972	1:1002
1970	37,000,000	2.70	240	33,197	30.27	494	21,068	2.84	734	54,265	19.62	1:50,409	1:685
1969	35,999,668	0.32	212	23,147	31.32	481	20,470	16.05	693	43,617	24.16	1:51,948	1:825
1968	35,883,000	3.17	181	15,897	(93.23)	477	17,184	0.52	658	33,081	(44.53)	1:54,533	1:1085
1967	34,744,310	3.28	198	30,717	42.30	480	17,094	35.87	678	47,811	40.00	1:51,245	1:727
1966	33,605,620	(2.56)	149	17,725	(27.00)	274	10,963	1.39	423	28,688	(16.15)	1:79,446	1:1171
1965	34,466,930		175	22,510		238	10,811		413	33,321		1:83,455	1:1034
Ave.		2.28	390	37,303	(1.06)	808	29,542	4.17	1,198	66,846	1.80	1:37,432	1:671

beds, the expansion is less remarkable : the total bed supply in 1965 of 33,321 merely doubled to 77,269 in 1990. Moreover, the 1990 level is actually lower than the 1980 level by 4,718 beds, notwithstanding a slight increase in the number of newly established hospitals since that same year.

As mentioned earlier, much of the increase in the country's total hospital bed capacity is traced to the establishment of new, albeit smaller, hospitals rather than the expansion of existing ones. As shown in Table 2 below, increases in the number of hospitals, both government and private were occasioned by reductions in the overall average bed capacity. The bed size of the average hospital at present (46) is almost half of the average hospital in the 60s, which also suggests that most of the facilities that have been built were providers of lower levels of hospital care, i.e., primary and secondary levels of care.

Table 2
Number of Hospitals and Average Bed Capacity:
Average Annual Change

	Hospitals			Bed Capacity Per Hospital		
	Govt	Private	Total	Govt	Private	Total
1980-1990	8	2	10	-3	0.4	-0.5
1972-1979	26	84	110	3.5	-3	-1
1965-1971	15	29	44	-8	0.7	-3

B. Ownership structure

From Table 2, we note that most of the entrants to the hospital sector during the period were from the private sector, except in the 80s when there were four new government hospitals that were recorded for every new private hospital annually. In earlier years, especially in the 70s, new private sector entrants outstripped government entrants, probably due to the introduction of Medicare. But note that even before the advent of Medicare, new private sector participants were already of greater import.

The government seemed to have altered their average bed capacity in opposite direction to that of the private sector. Whereas there was a very slight increase in bed capacity for every private hospital in 1990 over the 1980 level, government hospitals registered a reduction of 3 beds per hospital. It is also interesting to note that in the 70s, the extent of increase in average bed capacity among government hospitals is almost the same

as the extent of reduction observed among private hospitals.

Despite the above trends, government hospitals have remained bigger in bed capacity relative to their private counterparts. As of 1990, the average government hospital is twice the size of the private hospital. This picture is also borne by another indicator of hospital capacity, i.e, average book value of machinery and other equipment, buildings and other fixed assets. The basic source of this indicator is the 1988 Census of Establishments of the National Statistical Office (NSO) which sampled public and private providers of medical, dental, and other health services having at least five employees in all regions of the country. Since clinics have less than this number of employees, most of the respondents of the survey could have been hospitals. Tables 3.1 and 3.2 show that government providers had an average asset of P5.4 million which is about ten times than that of private providers. Discounting land and building since private hospitals may just be renting these, we note that the item "machinery and equipment" of private providers was about four times smaller than that of government providers.

The advantage of government hospitals in terms of bigger bed capacity also translates to their dominance of the sector. This picture has changed only slightly since 1965: government-owned hospital beds accounted for 68 percent of the total level in 1965 and went down slowly to 53 percent by 1990. In terms of facilities, the government's presence was also reduced from 42 percent of the total facilities in the country in 1965 to 34 percent in 1990.

However, the public-private sector mix across the 14 regions of the country do not uniformly echo the national picture. From data as of 1990, an index of ownership structure was constructed by getting the ratio of government hospitals (beds) to private hospitals (beds) mulitiplied by 100 (see Table 4). An index greater than 100 implies government sector dominance in the region or category of hospital; ratios lower than 100 indicate private sector dominance. (Appendix A further shows the number of government and private hospital beds per province as of 1991).

Private sector dominance in the provision of hospital beds is shown in four out of the 14 regions: Regions 4, 10, 11 and 12. The ownership mix is not also uniform across levels of hospital care. Due to their smaller average bed capacity, it is expected that private hospitals would be more significant compared to their public counterparts in the provision of primary care. However, there are certain regions where the private sector also surpasses the government even in the provision of beds for higher levels of care. In Regions 1, 4, 5, 11, 12 and the NCR, the secondary levels of care are private sector-dominated. Finally, the tertiary care market in Regions 4, 10, 11 and 12 are similarly structured in favor of the private sector.

Table 3.1
Public Medical, Dental and Other Health Services :
Average Book Value of Fixed Assets as of Dec. 31, 1988
(In Thousand Pesos)

Region	Total	Land	Buildings, Other Structures and Land Improvements	Transport Equipments	Machinery & Other Equipment	Other Fixed Asset
I	3,390	142	1,871	59	1,048	270
II	8,900	68	1,112	65	647	7,009
CAR	12,807	142	1,535	43	795	10,292
III	14,192	178	1,881	116	865	11,152
IV	19,846	89	1,614	94	640	17,409
NCR	206,128	5,072	22,715	663	8,850	168,829
V	41,613	39	2,296	59	794	38,425
VI	21,379	115	1,526	69	867	18,803
VII	12,171	750	1,612	162	1,039	8,609
VIII	7,999	57	1,341	49	698	5,853
IX	9,826	107	1,232	38	454	7,994
X	16,152	123	1,360	82	639	13,948
XI	10,940	508	1,648	140	1,523	7,121
XII	6,465	281	2,486	108	808	2,782
Total	5,443	487	2,935	119	1,304	598

Table 3.2
Private Medical, Dental and Other Health Services :
Average Book Value of Fixed Assets as of Dec. 31, 1988
(In Thousand Pesos)

Region	Total	Land	Buildings, Other Structures & Land Improvements	Transport Equipments	Machinery & Other Equipments	Other Fixed Asset
I	89	0	39	0	40	9
II	43	0	0	0	43	0
CAR	12	0	6	0	5	1
III	118	0	49	4	60	5
IV	120	30	17	11	56	6
NCR	1,597	10	368	18	1,187	14
V	56	0	43	0	13	0
VI	741	0	308	8	414	11
VII	265	0	157	27	81	0
VIII	115	0	31	2	73	9
IX	63	5	42	0	14	2
X	19	0	7	0	8	4
XI	103	0	38	6	34	25
XII	62	20	10	12	20	0
Total	505	8	131	10	347	10

Table 4 [1]

Index of Hospital Ownership Structure

Philippine Hospitals 1990

Region	Hospitals				Beds			
	Primary	Secondary	Tertiary	All	Primary	Secondary	Tertiary	All
I	18.42	73.91	160.00	48.48	21.47	72.75	246.78	105.49
II	30.30	210.00	400.00	79.55	36.70	369.05	800.00	249.71
CAR	30.00	175.00	200.00	91.18	22.73	161.29	267.49	130.40
III	11.67	67.92	61.54	40.48	19.00	135.59	179.78	121.58
IV	39.22	43.08	55.56	43.28	42.41	67.49	80.70	68.42
NCR	6.25	15.69	59.52	28.00	8.25	54.60	159.60	135.80
V	23.81	92.00	75.00	45.83	47.86	97.26	232.32	111.20
VI	92.86	350.00	90.00	156.25	89.95	434.54	90.30	138.59
Vii	66.67	140.00	50.00	84.00	67.41	314.78	71.60	121.92
VIII	120.00	241.67	350.00	200.00	95.07	396.89	388.89	325.32
IX	46.88	128.57	500.00	80.85	178.75	153.37	480.00	203.65
X	24.29	79.17	100.00	43.14	19.78	124.67	160.00	85.61
XI	9.52	72.22	77.78	20.92	5.30	38.64	92.59	32.12
XII	13.11	70.00	66.67	29.89	32.15	71.24	93.95	58.58
Total	25.04	84.57	80.58	50.54	32.11	122.92	147.57	110.43

[1]

$$\text{Index} = \frac{[\text{Total Government Hospitals (Beds)}]}{[\text{Total Private Hospitals 9Beds)}]} \quad (100)$$

C. Organizational profile

Table 5 summarizes the ownership and organizational form of 359 hospitals or about 76 percent of all licensed hospitals in Regions 2, 7, 10 and the NCR. This information was culled from the BLR Inspection Reports as of 1991.

Table 5

Ownership and nature of organization of hospitals

Nature of ownership	Region				
	2	7	10	NCR	Total
A. Private					
Single proprietorship	29	15	54	44	142
Partnership	0	0	0	1	1
Corporation	1	14	8	56	79
Missionary/religious	0	2	4	2	8
Civic organization/ foundation/cooperative	0	0	2	1	3
B. Public					
National/local government	34	27	32	32	125
Government corporation	0	0	0	2	2
T o t a l	64	58	100	138	360

Similar to the national data mentioned earlier, non-government entities established most of the hospitals (66 percent) in the four sample regions. Of these, 40 percent are organized as single proprietorships while over one-fifth are organized as corporations. Very few were set up by civic organizations, foundations, cooperatives and missionary or religious bodies.

As expected, majority of hospitals formed as single proprietorship offer primary levels of care while those with relatively more complex form of organization (corporation) tend to specialize in tertiary levels of care. Majority of government-owned hospitals are in the secondary care segment of the market.

As of end 1991, the Department of Health had under its jurisdiction the operation of 504 hospitals spread throughout the

country. These are categorized into eleven types according to their catchment area, bed capacity and level of services. Table 6 presents the average bed capacity of each type as established in various regions. A family planning center converted to a hospital is the smallest with only ten beds. Municipal hospitals and the Medicare hospitals offer primary care with average bed capacities ranging from 12 to 15. Except in Metro Manila, the regional hospitals and medical centers are at the top of the regional hierarchy; these provide tertiary care, with bed capacities ranging from 200 to 485. Specialty hospitals, i.e., the Philippine Health Center, the National Kidney Institute, the Philippine Medical Children's Institute and the Lung Center operate under their own special charters but are attached to the DOH for administrative supervision. The special hospitals have the largest bed capacity among all DOH hospitals and are so-called because they are designated as the national referral centers; all are located in the National Capital Region. Effective November 1992, however, most of the DOH hospitals (the municipal, Medicare, district and provincial hospitals) were among the offices devolved to the local government units.

Other government agencies including the Department of National Defense, state universities and city governments also operate 58 hospitals, the majority of which are larger than DOH hospitals.

D. Service mix

Under the Philippine hospital licensure system, hospitals with bigger bed capacities are also those which are supposed to provide "higher levels" of care, i.e., wider scope of services, particularly more specialized physician care and ancillary services. The Department of Health prior to 1989 classified hospitals as primary, secondary and tertiary depending on the facilities' bed capacity and scope of medical services[3] :

1. Primary hospitals are those with 6-25 beds and equipped with the service capabilities needed to support licensed physicians rendering services in medicine, pediatrics, obstetrics and minor surgery.

2. Secondary hospitals are those with 26-95 beds and capable of rendering additional clinical services in gynecology, general surgery, and medical ancillary services such as radiology and laboratory.

This was recently revised to exclude the bed capacity criterion.

Table 6

Government-Owned Hospitals
As of End 1991

Agency to which Hospital is Attached	Number of Hospitals	Average Bed Capacity
I. Department of Health		
Medicare*	72	15
Municipal*	64	12
District*	260	37
Provincial*	66	103
Regional	13	250
Special	6	1248
Specialty	4	241
Medical Centers	8	356
Sanitaria	8	615
Research	2	38
Family Planning Centers	1	10
Sub-Total	504	75
II. Other Government Agencies		
City Government	18	89
Military (Department of National Defence)	24	202
Universities	4	59
Others	12	156
Sub-Total	58	506
III. TOTAL	562	82

* Devolved to the Local Government units effective November 1992

Source : BLR Masterlist of Hospitals

3. Tertiary hospitals have 100 beds or more with service capabilites needed to support medical specialists rendering services in the sub-specialties of the five clinical fields.

An indicator of the diversity or mix of services of the three hospital types may be gleaned from the distribution of discharges according to the major departments of Medicine, OB-Gyne, Pediatrics and Surgery. This is shown in Table 7 which also presents the total discharges in 1991 of the licensed hospitals in Regions 2, 7, 10 and NCR included in the BLR data set:

Table 7 :
Average No. of Discharges and Distribution by Department of Cases Treated in Regions 2, 7, 10 and NCR in 1991

	Government			Private		
	P	S	T	P	S	T
Discharges per hospital	1137	2485	11088	1030	2447	8483
of which from						
Medicine (%)	46.98	40.29	36.25	49.35	44.84	38.01
Surgery (%)	3.92	7.30	12.00	2.21	7.91	11.51
OB-Gyne (%)	7.71	18.01	22.35	10.74	16.13	21.00
Pediatrics (%)	39.75	27.47	23.42	34.90	28.00	25.64
Others (%)	1.64	6.94	9.58	2.80	3.13	3.84

Legend : P-primary; S-secondary; T-tertiary.

"Simpler" cases such as those treated in the Medicine and Pediatrics departments dominate the service mix of all types across ownership types but to a lesser extent among the higher care facilities. Higher care facilities vis-a-vis lower care facilities tended to have more (percentage wise) of those services with generally more sophisticated medical protocols such as surgery and OB-Gyne.

E. Profile of patients by payment scheme

The BLR hospital reports classify patients according to three major financing types : (a) pay ; (b) Medicare; (c) charity or service patients. "Pay" patients in private hospitals and specialty

government hospitals are normally those who are accommodated in suites, private, semi-private and pay wards. On the other hand, "pay" patients in government hospitals are those accommodated in pay wards, though they are charged at subsized prices[4]. Medicare patients are those who file claims against Medicare; note that about 16 percent of hospitalized Medicare members do not (PIDS-DOH Household Survey, 1993). Charity patients in private hospitals are those accommodated in "service" wards which are normally the lowest-priced; in government hospitals, charges may be as low as zero.

It should be pointed out that services corresponding to each patient type are likely to vary across hospitals. There is not much information as of now to assess, for example, the uniformity (or lack of it) of the price and quality of charity wards of government hospitals. It may be that the price and quality of charity wards in tertiary facilities are more comparable with those for the pay (rather than charity wards) in primary facilities.

Table 8 summarizes the mix of patients of the licensed hospitals in our data set :

Table 8

Distribution of Patients by Payment Scheme*

	Charity	Medicare	Pay
Government			
Primary	33.16	25.95	40.89
Secondary	68.67	11.53	19.80
Tertiary	83.33	7.49	9.18
Private			
Primary	17.58	57.66	24.76
Secondary	29.34	32.11	38.55
Tertiary	25.96	22.31	51.74

* Based on reports of licensed hospitals from Regions 2, 7, 10 and NCR
Source of raw data: Hospital Statistical Reports (BLR, 1991)

Four observations emerge from the table as follows :

1. Focusing on the patient mix of government hospitals alone, we

[4] Except for the specialty hospitals which were organized as government corporations and are consequently given autonomy with respect to pricing, government facilities are supposed to be "guided" by a price list issued in 1981. In practice, however, this is not followed.

note that majority of the users of primary facilities are pay patients and not charity cases as one would expect of government hospitals. This is true for the representative hospital in Regions 2, 10 and the NCR. The latter observation applies though to government secondary and tertiary hospitals.

The higher shares of pay patients among primary facilities vis-a-vis- secondary and tertiary facilities could be due to the relative inexpensiveness of their services as compared to the higher level facilities. More users could therefore afford "pay" services in lower facilities relative to that offered in secondary or tertiary facilities.

2. Focusing on the patient mix of private hospitals alone, the dominant group of users among primary facilities are the Medicare patients. For both secondary and tertiary facilities, pay patients comprise the majority. In contrast to primary facilities, Medicare patients are the least important for private tertiary hospitals. For secondary private hospitals, Medicare and charity patients have almost the same weight. Charity patients are the least important for primary facilities.

3. Comparing government and private facilities, the former in general tends to concentrate on charity cases while the latter on pay patients. (Exceptions have been mentioned earlier). This is quite consistent with the reported income profile of their users: government facilities estimate that around 75 percent of their admissions are from the low-income class vs. 40 percent reported by private facilities[5]. From Tables 7 and 8, we can also infer that private facilities have one to two more Medicare patients than their government counterparts.

4. With regard to charity patients, we note that these account for greater shares as one goes to higher hospital levels, irrespective of ownership. Consequently, it seems that both pay and Medicare patients are "crowded-out" in government hospitals while only Medicare patients are "crowded-out" in private facilites. Seemingly private hospitals support an increase in the number of charity cases by admitting higher number of pay patients.

A hospital would not be able to treat a Medicare enrollee without obtaining accreditation with the agency. Thus, we would expect the number of pay and Medicare patients admitted in an average government or private hospital to depend on the propensity

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[5] This is further corroborated with data on the choice of facilities of households: approximately 73 percent of those in the lowest income bracket chose to seek medical care in government facilites vs. 21.43 percent who sought private facilities. (PIDS-DOH Household Survey, 1993).

of the hospital to qualify for accreditation with Medicare and private financing schemes. Some information on this is culled from the DOH-PIDS Hospital Administrators Survey (1993) which covered 159 hospitals in Regions 2, 7, 10 and the NCR.

From Table 9, majority of hospitals across ownership and types of care were accredited to admit Medicare enrollees, but the secondary and tertiary facilities had greater likelihood of accreditation.

The picture differs when it comes to accreditation with private insurance schemes : private hospitals, regardless of the type of care they provide, were more likely to have ties with these schemes as compared to government hospitals. There may be two reasons for this : (a) the perception that private hospitals offer better quality of care than government facilities; or/and (b) the lack of incentives for government hospitals to push for accreditation in view of the financial support they receive from the national government.

Table 9 : Pattern of Hospital Accreditation with Medicare and Private Insurance Schemes

	% of Hospitals Accredited with Medicare	% of Hospitals Accredited with Private Insurance Scheme
Government		
Primary	66.67	0.00
Secondary	95.00	10.00
Tertiary	100.00	9.09
Private		
Primary	80.00	26.67
Secondary	95.45	31.82
Tertiary	100.00	87.50

* Source of raw data: PIDS-DOH Hospital Administrators Survey (1993)

F. Pricing pattern

Based on standard demand analysis, the number of patient admissions or visits would depend on the charges collected by the hospital from the patient. Variation in prices of hospitals sampled in the DOH-PIDS Hospital Administrators Survey (1993) are summarized below. The structural components of these prices - marginal cost and mark-ups or subsidy - or more specifically those of an average government and private hospital, are the main subject of this paper and are discussed further in the succeeding sections.

Table 10 :
Government and Private Hospital Prices
as of 1991

	In-patient fee (P) per discharge	Out-patient fee (P) per contact
Government		
Primary	156.79	18.68
Secondary	182.35	17.05
Tertiary	870.67	21.50
Private		
Primary	779.84	121.87
Secondary	1180.08	109.63
Tertiary	4463.18	342.47

* Source of raw data: PIDS-DOH Hospital Administrators Survey (1993)

III. A Theoretical Model of Government and Private Hospital Pricing Behavior

The hospital may be viewed as a firm which combines various inputs (physical capital, labor and supplies) to produce throughputs (medical, hotel and support services). The latter are in turn used in the production of the final output of the hospital: the improvement or recovery of its patients' health status. How these are achieved would expectedly vary from hospital to hospital considering their differences with respect to objectives and the constraints they face in meeting those objectives.

The hospital industry in the country has a mixed ownership structure. As of 1991, majority of the hospitals (66 percent) were established by the private sector. This section aims primarily to present a simple framework for examining the supply decisions of government and private hospitals. In the absence of a more convenient and objectively measurable indicator of the health status of hospital users, we limit ourselves to two proxy indicators of output : in-patient (IP) discharges and out-patient (OP) contacts or visits.

We assume that decisions are made by the chief of hospital who has two considerations : (a) pecuniary benefits of the owners from the hospital's operations; and (b) the non-pecuniary benefits of its catchment area from the hospital's services, specifically health status improvement. In the discussion that follows, we propose to distinguish government and private hospitals by the weights attached by the decision-maker on these criteria. A private hospital chief is posited to fully accommodate the interest of an income maximizing owner while a government hospital chief decides more heavily in favor of its catchment area. In between the two cases is a hospital chief who considers both. A typical private hospital may profess to have preferences as this "middle case."

The salaried chief of a private hospital would want to consider the owners' pecuniary benefits as this affects him directly. His salary increases and the stability of his position within the organization's hierarchy would depend on his performance as perceived by an income-maximizing owner. The higher the hospital's net profits, the higher his salary. We may note that in most hospitals, particularly those in the primary and secondary levels, this distinction between owners and administrators becomes irrelevant as these posts are, more often than not, held by the same person/s.

It may be argued that profit-maximization would not be an appropriate assumption for private voluntary providers, i.e., those legally organized as non-profit institutions which as of 1991 and according to data for Regions 2, 7, 10 and NCR, comprised 9 percent of all private hospitals (BLR, 1992). A number of theoretical

studies, however, point out that profit can be a proxy for objectives funded with the excess of revenues over costs such as: (a) acquisition of sophisticated services that enhance the prestige, power and professional satisfaction of the administrator (Lee, 1971); (b) expansion of available facilities to resolve conflicts among administrators, medical staff and other interest groups (Harris, 1977); and (c) the income of medical staff who are de facto in control of the hospital (Pauly and Redisch, 1973). Following these models, we also assume that the behavior of private non-profit institutions is not predicated upon their legal status.

On the other hand, a salaried government-owned chief of hospital will not be concerned about profit generation since the owner's (government) evaluation of his performance does not take this into account. His salary is fixed irrespective of hospital revenues. Placing this set-up in the context of the decision-making in government, the chief of hospital is personified by the Secretary of Health while the owner would be represented by Congress. It is Congress that appropriates funds for building and maintaining the operation of the hospital. In this simple model, the Secretary is assumed to be primarily driven by his concern to improve the health status of the catchment population.

Suppose we have a chief of hospital j who considers both pecuniary and non-pecuniary factors in his decision-making. He chooses the fees per discharge (P_{jd}) and per OP visit (P_{jk}) that maximizes his utility (U_j) which has as arguments the hospital's net income (Y_j) that accrues to the owner, and the health status (S) of its catchment area :

(1) $$U_j = \alpha_j Y_j - (1-\alpha_j) S$$

subject to

$$Y_j = P_{jd}*D(P_{jd},P_{jk}) + P_{jk}*K(P_{jd},P_{jk}) + B_j - C_j(D_j,K_j)$$
$$S = S(D_j+D_{-j},\ K_j+K_{-j})$$
$$0 \le \alpha_j \le 1$$

where :

Y_j : Net income
D_j : Level of hospital discharges
P_{jd} : Fee per discharge
K_j : Number of out-patient visits
P_{jk} : Fee per visit
C_j : Total operating cost
S_j : Measure of the catchment area's ill health
D_{-j} : Discharges of other providers
K_{-j} : OPD visits to other providers
B_j : Government subsidy

The weights given to profits and concern for the area's health status in the decision-making is shown in the parameter α : as this approaches 1, the decision-maker is driven more by profit-making relative to improving health status or reducing ill health in the area. He will be less concerned about the effects of higher prices on public health relative to the higher income that this will yield. At the extreme, if $\alpha_j = 1$, the hospital does not at all differ from any profit-maximizing firm in his decision-making.

Net income is simply the sum of total revenues from discharges and OPD visits plus budgetary support minus the total cost of operation. Discharges and OPD visits are assumed to be negatively related to their own prices, and positively related to each other's prices if they are substitutes. However, if inducement exists (e.g doctors in hospitals may prescribe OP visits to discharged in-patients) the cross price effects could be positive.

Ill health (S) is posited to decline with the utilization of health facilities in the area. Since utilization is negatively affected by prices, S then increases with higher prices. Decision-makers characterized by low α_j will be less inclined to raise prices as against those with higher values of α_j.

Solving for the first order condition and further simplification will give us the optimal prices for discharges and OPD visits as follows:

$$(2) \quad P_{jd} = \partial C_j/\partial D_j - D_j/(\partial D_j/\partial P_{jd}) + [(\partial C_j/\partial K_j)*(\partial K_j/\partial P_{jd})]/(\partial D_j/\partial P_{jd}) - P_{jk}(\partial K_j/\partial P_{jd})]/(\partial D_j/\partial P_{jd}) + [(1-\alpha_j)/\alpha_j](\partial S_j/\partial D_j) + \{[(1-\alpha_j)/\alpha_j][(\partial S_j/\partial K_j)(\partial K_j/\partial P_{jd})]\}/(\partial D_j/\partial P_{jd})$$

$$(3) \quad P_{jk} = \partial C_j/\partial K_j - K_j/(\partial K_j/\partial P_{jk}) + [(\partial C_j/\partial D_j)*(\partial D_j/\partial P_{jk})]/(\partial K_j/\partial P_{jk}) - P_{jd}(\partial D_j/\partial P_{jk})]/(\partial K_j/\partial P_{jk}) + [(1-\alpha_j)/\alpha_j](\partial S_j/\partial K_j) + \{[(1-\alpha_j)/\alpha_j][(\partial S_j/\partial D_j)(\partial D_j/\partial P_{jk})]\}/(\partial K_j/\partial P_{jk})$$

<u>Pricing and hospital ownership</u>

The first terms on the right-hand side of the equations are simply the marginal cost of the service, the second terms are equal to the mark-up of the hospital for that service, the third terms are the marginal cost of the other service and fourth terms are the marginal revenue from that other service. The fifth and the last terms are the marginal effects on public health of the changes in the utilization of the services due to the price effects, weighted by $[(1-\alpha_j)/\alpha_j]$. The last two terms give the difference between profit-making prices and the utility-maximizing prices decided by the administrator. This difference is in effect a discount on the market price since we assume that greater utilization of the services have a dampening effect on the catchment area's ill health

$[(\partial S/\partial D_j) < 0; (\partial S/\partial K_j) < 0]$. The greater is the value assigned to α_j, the lower the discount. Hence, the more importance private hospital owners attach to profit-making, the more their prices approach the market price; on the other hand, government hospitals driven primarily by health considerations for their catchment population will give relatively greater discounts.

The amount of the discount does not only depend on the marginal utility from income relative to the marginal disutility from ill health. The more the services are perceived to be effective in addressing public health - i.e the greater the values of $\partial S/\partial D_j$ and $\partial S/\partial K_j$ are - the greater the discount.

Note, moreover that if demand inducement exists, i.e in-patient and out-patient services are complementary rather than substitutes, the discount will be greater since the last two terms will now have the same (negative) signs. Also, the larger discount, the greater the cross price effects, and the more inelastic the demand for the service itself. In other words, "basic services" will be imputed greater price cuts.

On the other hand, if in-patient and out-patient services are substitutes (for example, doctors may prescribe a series of out-patient visits rather than in-patient confinement in treating an episode of illness), the last two terms will now have opposite signs and the discount will be lower, and may be negative if say, for discharges we have

$$|(\partial S/\partial D_j)| < |[(\partial S/\partial K_j)(\partial K_j/\partial P_{jd})]/(\partial D_j/\partial P_{jd})|$$

or

$$|(\partial S/\partial D_j)(\partial D_j/\partial P_{jd})| < |[(\partial S_j/\partial K_j)(\partial K_j/\partial P_{jd})]|$$

Hence, if the own-price and cross-price effects of in-patient price are of the same magnitude, but government hospitals perceive acute in-patient care to be a less effective public health instrument compared to out-patient visits which are more preventive in nature, cross subsidies may even be imposed. A discharge in government hospitals may then be priced more than that of a private hospital discharge, but the opposite will hold for out-patient visits. But, as earlier mentioned this scenario hinges on the relationship between in-patient and out-patient care.

Hospital pricing and the size of the catchment population

The greater the incidence of illness in the catchment area of the hospital, the larger will be its catchment population. How could this affect hospital pricing?

We can re-write the amount of discount or subsidy for an in-patient discharge as follows:

$$\text{Discount} = [(1-\alpha_j)/\alpha_j]\{(\epsilon_{sd}*S/D_j)(\partial D_j/\partial P_{jd}) + (\epsilon_{sk}*S/K_j)(\partial K/\partial P_{jd})]\}/(\partial D_j/\partial P_{jd})$$

where $\epsilon_{sd} = (\partial S/\partial D_j)* D_j/S_j$ and $\epsilon_{sk} = (\partial S/\partial K_j)* K_j/S_j$

If it can be assumed that the effectiveness of in-patient discharge and out-patient visits as measured by ϵ_{sd} and ϵ_{sk} does not vary from one catchment population to another, the discount will be larger in areas with poorer health status, that is, those areas with larger values of S. Hence government hospital prices in such areas would be lower, holding other things constant.

Sensitivity to the epidemiological profile of the population depends again on the parameter α_j. If this is equal to 1, hospital pricing will not adjust downward in areas with poorer health status. (On the contrary, if the demand curve for hospital care shifts upward as the catchment population grows, hospital prices will be higher in larger unhealthy communities).

Hospital pricing and insurance

Insurance schemes for medical treatment in Philippine hospitals, particularly Medicare, largely cover in-patient discharges only. Suppose σ percent of in-patients are covered by insurance with a support value equal to δP_{jd}. Demand for hospital services (discharges and OPD visits) will now be as follows:

$$D_j = \sigma_j*D_j(P_{jd} - \delta_j P_{jd}, P_{jk}) + (1-\sigma_j)*D_j(P_{jd}, P_{jk})$$
$$K_j = \tau_j*K_j(P_{jk}, P_{jd} - \delta_j P_{jd}) + (1-\tau_j)*K_j(P_{jk}, P_{jd})$$

The fee per discharge now faced by σ percent of in-patient admissions is the out-of-pocket price $(P_{jd} - \delta_j P_{jd})$ while the rest of the patient admissions face the same price P_{jd}. Meanwhile τ_j percent of out-patient contacts (τ_j may or may not be equal to σ_j) of those whose in-patient treatment are also insured also face lower in-patient prices but the same out-patient fee. The partial effect of discharge fees on hospital discharges and OPD visits will now be:

$$\begin{aligned}\partial D_j/\partial P_{jd} &= \sigma_j(D_j/\partial P_{jd})(1-\delta_j) + (1-\sigma_j)(\partial D_j/\partial P_{jd}) \\ &= (\partial D_j/\partial P_{jd})[\sigma_j(\delta_j) + (1-\sigma_j)] \\ &= (\partial D_j/\partial P_{jd})[1 - \sigma_j\delta_j]\end{aligned}$$

$$\begin{aligned}\partial K_j/\partial P_{jd} &= \tau_j(\partial K_j/\partial P_{jd})(1-\delta_j) + (1-\tau_j)(\partial K_j/\partial P_{jd}) \\ &= (\partial K_j/\partial P_{jd})[\tau_j(1-\delta_j) + (1-\tau_j)] \\ &= (\partial D_j/\partial P_{jd})[1 - \tau_j\delta_j]\end{aligned}$$

The demand for in-patient treatment would now become less elastic as the support rate (δ_j) increases or/and patient coverage (σ_j) expands, and so would the cross-price effect of the discharge fee on OPD visits. As Feldstein (1981) argues, insurance diminishes

the responsiveness of users to prices which at the outset is reduced by his ignorance of available alternatives and their prices. In addition, to the extent that insurance reduces the out-of-pocket cost to the patient, it also reduces possible patient reluctance to comply with medical regimens requiring in-patient care, thereby facilitating increases in physician-originated demands (Berki, 1972).

As the hospital faces a less elastic demand curve, the second term of the discharge price equation indicating the mark-up will then be higher. The second, third and last terms will be greater or lesser than without insurance depending on the values of σ_j and τ_j : if these are equal, these terms will be unchanged. Insurance for in-patient care in profit-maximizing hospitals given this scenario will be inflationary and this is due to the higher mark-ups or rents of hospitals. Among government hospitals, the net subsidy (i.e., the last two terms in the price equation minus the mark-up) will be smaller, and this also leads to higher in-patient price.

If $\sigma_j > \tau_j$ and the two services are substitutes and as long as the marginal cost of an out-patient visit ($\partial C_j/\partial K_j$) is less than its price (P_{jk}), in-patient admissions in profit-maximizing hospitals will also be found higher after insurance. If they are complementary, the opposite will hold. A similar picture also applies to government hospitals.

The literature on the inflationary effects of insurance on hospital prices in the U.S. suggests another route : as enrollment in the schemes becomes more prevalent, hospitals engage less in price competition and more in non-price or quality competition. The more complete the insurance coverage, the more physicians will become less concerned with the cost of patient care. Physicians would demand more provision of hospital throughputs - more sophisticated diagnostic apparatus, medical aides and amenities- to improve their productivity or profits (Pauly and Redisch, 1973). The greater the competition for admissions, the higher the quality of ancillary services that hospitals will offer in attempting to attract physicians (Pope, 1989; Joskow, 1980; Romeo, Wagner and Lee, 1984). The resulting investments lead to greater fixed and recurrent costs; in other words the marginal cost curves also shift upward.

Hospital pricing and market structure

Analyses in standard microeconomic textbooks tell us that perfect competition among firms will be manifested in the pricing rule where price is simply equal to marginal cost. *The presence of mark-ups is indicative of the existence of market power*. It is not hard to conjecture how market power in the hospital industry can be generated since each hospital could sell differentiated services purchased by relatively uninformed consumers. Hospital services

may be differentiated in several ways. The most common example would be "room and board" or hotel services which are varied among hospitals according to the presence of amenities such as telephones, refrigerators, toilet and bath, companion's bed, etc. Ancillary services such as diagnostic examinations are similarly differentiated by the type and age of machines as well as supplies used and waiting time for users in retrieving the results. Empirical studies on U.S. hospitals and physicians also point out that the characteristic or attributes of facilities themselves may matter : services received in public hospitals are thought to be less attractive vis-a-vis those from private, or those of non-teaching vis-a-vis teaching hospitals, or those located in urban centers vis-a-vis rural areas (Feldman and Dowd, 1986; Pauly, 1982).

In addition, few providers characterize the industry. As of 1991, there were 1663 hospitals located in 14 regions of the country, with the average hospital having a bed capacity of 49 beds (BLR,1992) suggesting also that most hospitals are providers of secondary level of care. (See *Appendix A* for the provincial distribution of government and private hospitals and hospital beds, by level of care as of 1991). Theory tells us that this could be due to the presence of economies of scale in relation to the size of the catchment area (Feldstein, 1988). For a given size of market, more providers will be able to exist; consequently the smaller is the level of services that has to be produced at the least cost. Conversely, the larger the level of services required to produce at the least cost, the fewer the number of providers.

In terms of the price equation earlier presented, the presence of mark-ups clearly leads to higher prices, and consequently, to lower level of services provided among profit-maximizing hospitals. The existence of insurance schemes further enhances the ability to differentiate their products. Among government hospitals, the potential power to collect rent is mitigated by the subsidies or discounts given to their patients. These discounts in effect shift their supply or marginal cost curve downwards, hence their equilibrium prices are lower and levels of utilization are higher than otherwise.

Earlier it was posited that the amount of subsidy or discount to patients will be more substantial in areas with larger catchment population. The more providers there are in a given catchment area, however, the smaller the catchment population of a government hospital. This in effect reduces the magnitude of public health concerns which they have to address (represented by S in the price equation) and this could consequently mean for them a smaller amount of subsidy per patient.

IV. Data and Estimation Procedure

A. Estimation procedure

In the preceding section we posited that deviations of government and private hospital pricing from their profit-maximizing levels may be explained by their concern for public health which is manifested by the amount of discounts or subsidies extended to their patients. Moreover, due to disparities in the importance they attach to profit and public health, government and private subsidies will accordingly differ. Our basic approach in showing the extent of this disparity is as follows: (a) estimate the profit-maximizing prices of both groups of hospitals; and (b) compute the subsidies per discharge and per out-patient visit of both groups by getting the difference between their actual prices and the estimated profit-maximizing prices from (a). Doing these will allow us to trace the source of the actual variation between government and private hospital prices, whether these are due to factors underlying the profit-maximizing levels (i.e., marginal costs and mark-ups) or simply due to their subsidy policy. This exercise will also give us a sense of the possible scenarios that may emerge if say, government hospitals will "privatize" their pricing policies, e.g., follow marginal cost (or marginal cost plus mark-up) pricing.

To proceed with (a), estimates of marginal costs and mark-ups are derived from cost and demand functions. A secondary objective in doing the latter is the estimation of the effects of insurance variables (support value and patient coverage), catchment area size, and market structure on the utilization of hospital in-patient and out-patient services and their prices.

To generate the parameters needed in estimating the profit-maximizing prices, the following cost and demand functions were done simultaneously via three-stage least squares estimation for the separate sample groups of government and private hospitals. Regressions were also done for the pooled data set to facilitate the application of the "Chow" test which is a way of testing whether or not the parameter values associated with the sampled government hospitals are the same as those associated with the sampled private hospitals:

Cost function

The marginal costs of hospital discharges and out-patient visits are generated from the following Cobb-Douglas cost function:

$$\ln C = c_0 + c_1 \ln D + c_2 \ln O + c_3 \ln W + c_4 \ln B + c_5 S + c_6 E + u;$$

where C : total annual operating cost of the hospital
D : total annual discharges
O : total annual out-patient contacts/visits
W : average monthly wage of hospital personnel
B : total bed capacity
S : ratio of total Surgery Department patients to total patients
E : dummy variable indicating the presence of X-ray or ECG or ultra-sound machine or CT Scan or MRI
u : error term
ln( ): natural log of the variable

Since we consider the hospital as a multi-output plant, the two broad indicators of output (discharges and out-patient visits) appear in the cost function. In our problem, these are endogenous and their "instruments" are described below. Average wage is included as a proxy variable for input prices.To control for the case mix of the hospital, the share of Surgery Department patients to total patient load is also included.

Bed capacity and the dummy variable for equipment (E) are used as proxy measures of the hospital's capacity. E is also a structural measure of quality to the extent that the presence of machines (and the medical technologists that operate them) conveys the ability of the hospital to deliver equipment-aided diagnostic services. Note that X-ray and and the ECG machine are required for licensing of secondary and tertiary hospitals while the MRI and CT Scan are representative of the more recent so-called prestige technology.

Demand functions

The second set of parameters needed in computing the profit-maximizing prices are the mark-ups of hospitals and the cross-price effects (between discharges and out-patient visits), and these are derived from the demand functions. Since we need a functional form that will be consistent with the logarithmic specification of outputs on the right hand side of the foregoing cost function, the demand for hospital admissions (or discharges as used in this study) and out-patient visits is specified as semi-logarithmic functions of their own prices and other demand variables as follows:

$$\ln D = d_0 + d_1 P_d + d_2 \ln I + d_3 OB + d_4 B + d_5 \ln F + d_6 \ln M + d_7 P_k + d_8 E + d_9 X + v;$$

$$\ln O = o_0 + o_1 P_k + o_2 \ln I + o_3 OP + o_4 B + o_5 \ln F + o_6 P_d + o_7 E + o_8 X + e;$$

where P_d : average fee per discharge
P_k : average fee per out-patient contact or visit
I : total number of persons in the province with health complaint
OB : total bed capacity of other hospitals in the municipality
OP : average hospital out-patient fee in the province
F : average fee charged by physicians per hospital in-patient episode in the municipality
M : average support value per insured patient of the hospital
X : average annual household expenditures per province
v, e: error terms

To control for the size of the catchment area of the hospital, we are not using population in the regression but, instead the number of people with any health complaint in the province (I); this is deemed to be a more specific measure of the catchment population since it also controls for the epidemiological profile of the area. Implicit in this measure is the assignment of the province as the catchment area of the average hospital. However, when controlling for the presence of other hospitals, we considered only those found in the municipality where the sample hospital is located since a collinearity test shows high correlation between the total number of complaining persons at the provincial level and the total bed capacity of other hospitals in the province. The latter was thus counted at the municipal level. For the out-patient visit demand function, the average OP fee in the province is used instead of other beds.

Doctors are normally the key agents involved in making decisions on whether patients should be admitted to the in-patient department or referred to the out-patient units of the hospital. In the two demand functions considered in this study, we explicitly consider the role of physicians by having the average physician fee charged in the municipality (F) as an explanatory variable. In having this in the demand equations of both private and government hospitals, we are also assuming that all hospitals in the area are open-staffed, i.e., hospitals allow all physicians in the area to have their patients admitted in the facility and charge professional fees including those with admissions in a government hospital.

The average support value from the hospital's insured patient (M) used in the regression for discharges is a proxy for the actual average insurance support rate. This was resorted to since the latter is simply the ratio of the average support value to the average fee per patient. Using the ratio could result in a multi-collinearity problem.

Finally, the demand functions also control for the average income and/or the standard of living in the hospital's catchment

area by having the average annual household expenditures at the municipal level (X) as additional regressor. The municipal level was also used instead of the provincial level due to the high correlation of the latter with the number of sick people at the provincial level.

Price functions

Both demand functions described above have as regressors our endogenous choice variables (P_d and P_k). To come up with statistically consistent estimates, the exogenous variables appearing in both the cost and demand functions above plus an identifier, and subsidy per bed day received from the national government, are combined to create the instrumental variables for prices as follows:

$$P_d = f_0 + f_1F + f_2W + f_3B + f_4OB + f_5M + f_6G + f_7I + f_8E$$

$$+ f_9X + f_{10}S + f_{11}H + t;$$

$$P_k = e0 + e_1F + e_2W + e_3B + e_4OP + e_5G + e_6I + e_7E$$

$$+ e_8X + e_9S + e_{10}N + s;$$

where H : ratio of insured patients to total patients
N : average out-patient clinics'(OPC) consultation fee in the municipality
G : subsidy from central government per bed-day
t,s: error terms

The rationale for including the ratio of insured patients to total patients (H) as an identifier in the discharge fee function is given in the preceding chapter. It is surmised that mark-ups of hospitals could increase as the insurance coverage of patients expands. The average OPC fee per visit (N) appearing in the out-patient fee function is another market variable. Finally, the amount of subsidy per bed-day from the national government is also included as instruments in both price functions.

B. Data

Data used in this study are taken from the Philippine Institute for Development Studies (PIDS) - Department of Health (DOH) Hospital Administrators Survey (1993), the PIDS-DOH Household Survey (1993), the PIDS-DOH Out-Patient Clinics Survey (1993) and the 1991 DOH-Bureau of Licensing and Regulations Hospital Statistical Reports and 1992 Hospital Masterlist Report.

All variables specific to the hospital itself (total discharges, average fee per discharge, total out-patient visits,

average fee per OPD visit, total operating cost, average wage, total beds, presence of equipment, case mix, insurance support value, insurance coverage of patients, and subsidy from the national government) were sourced from the Hospital Administrators Survey. All data from this source refers to the 1991 annual operation of the sampled hospitals which totalled to 159 facilities from the following provinces: Cagayan and Quirino in Region 2 (Cagayan Valley), Bohol and Cebu in Region 7 (Central Visayas), Misamis Oriental and Surigao del Norte in Region 10 (Nothern Mindanao Region) and the National Capital Region. However, only 65 hospitals submitted the data set required in our estimation:

Table 11.
Distribution of Final Sample Hospitals

Province	Government			Private		
	1°	2°	3°	1°	2°	3°
Bohol	2	2	2	0	4	0
Cagayan	1	5	1	2	2	0
Cebu	1	5	0	0	3	3
Misamis Oriental	1	2	1	4	0	0
NCR	0	1	3	2	8	4
Quirino	1	1	1	0	0	0
Surigao del Norte	2	2	1	0	1	0

1° - primary level of care; 2° - secondary; 3° - tertiary

The average fees per discharge were not directly lifted from the survey; these were generated by dividing total annual revenues from the in-patient department as given in the survey by the total number of discharges in 1991. Annual revenues excludes those received from the government but includes those received from patients, Medicare, HMOs and other insurance schemes. As shown in Tables 12A and 12B, the computed fees per discharge in government hospitals ranged from P31.53 to P678.00; that of the private sector went from 17.50 to P8,333.61. (The descriptive statistics for government hospitals by province are shown in *Appendix B1-B7*; those for private hospitals are given in *Appendix C1-C6*).

The average fees per out-patient were similarly computed; these are simply the ratio of total revenues from out-patients to total out-patient contacts. Total out-patient contacts include out-patient examinations done in the OPD department and out-patient visits to the hospitals' radiologic, laboratory and other ancillary services. OPD fee in government hospitals ranged from P0.31 to P98.47; those of private hospitals from P1.81 to P309.12.

Table 12A. Descriptive Statistics of Sampled Government Hospitals

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	214.77	143.40	31.53	678.25
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	19.17	22.92	0.31	98.47
Total Discharges	Total in-patient discharges	3956.97	3992.36	578.00	16103.00
Ln(Discharges)	Natural log of total in-patient discharges	7.88	0.88	6.36	9.69
Out-Patient Visits	Total out-patient visits	22600.48	27726.58	786.00	104038.00
Ln(Out-Patient Visit)	Natural log of out-patient visits	9.37	1.19	6.67	11.55
Doctors Fee	Average fee of physicians in municipality where hospital is located, weighted by type of hospital admisions (e.g. charity, payward, semi-private/ private, suite)	700.48	520.51	275.00	2183.90
Ln(Doctors fee)	Natural log of doctors fee	6.04	0.63	5.62	7.69
Beds	Total number of hospital beds	81.70	86.40	10.00	390.00
Ln(Beds)	Natural log of hospital beds	3.96	0.94	2.30	5.97
Other Hospital Beds	Total number of beds in other hospitals in the same municipality	543.67	1707.02	0.00	7689.00
Surgical Patients	Ratio of surgery department discharges to total discharges	0.09	0.06	0.00	0.26
Subsidy per Bed Day	Average subsidy per bed day from government	442.25	190.76	22.21	847.39
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	75.96	81.09	7.21	438.10

Table 12A. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Insurance Support	Average reimbursement from insurance schemes including medicare per insured discharge	1666.34	4818.47	95.75	28189.75
Ln(Insurance Support)	Natural log of insurance support	6.43	1.19	4.56	10.25
Insured Patients	Ratio of insured discharge to total discharges	0.18	0.13	0.01	0.56
Wage	Average wage per hospital personnel (monthly)	3545.68	916.77	801.74	5580.96
Ln(Wage)	Natural log of wage	8.13	0.36	6.69	8.63
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	320.10	417.49	22.97	1359.90
Ln(Illness Incidence)	Natural log of illness incidence	12.05	1.11	10.04	14.12
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	52.37	22.79	20.00	114.50
Total Cost	Total operating cost (in Thousand pesos)	12709.30	164540.00	1173.23	85630.30
Ln(Cost)	Natural log of total cost	15.80	1.08	13.98	18.27
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan \MRI	0.65	0.36	0.00	1.00
Household Expenditures	Average annual household expenditures in municipality	21315.14	15675.11	3122.60	57243.80

Number of observations = 33

Table 12B. Descriptive Statistics of Sampled Private Hospitals

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	1692.38	2199.71	17.50	8333.61
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	128.43	90.03	1.81	309.12
Total Discharges	Total in-patient discharges	2796.06	3481.40	120.00	14356.00
Ln(Discharges)	Natural log of total discharges	7.34	1.16	4.79	9.57
Out-Patient Visits	Total out-patient visits	6893.72	7045.29	703.00	35040.00
Ln(Out-Patient Visits)	Natural log of out-patient visits	8.43	0.94	6.56	10.46
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private/ private, suite).	1804.04	1096.16	367.55	3946.82
Ln(Doctors fee)	Natural log of doctors fee	7.30	0.67	5.91	8.28
Beds	Total number of hospital beds	50.22	58.66	7.00	246.00
Ln(Beds)	Natural log of hospital beds	3.50	0.87	1.95	5.51
Other Hospital Beds	Total beds of other hospitals in the same municipality	1951.88	2610.29	0.00	8057.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	1486.59	2076.16	6.10	9845.51
Ln(Insurance Support)	Natural log of insurance support	6.33	1.73	1.81	9.19
Insured Patients	Ratio of insured discharge to total discharges	0.48	0.30	0.09	1.00

Table 12B. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Surgical Patients	Ratio of surgery department discharges to total discharges	0.09	0.09	0.00	0.25
Wage	Average wage per hospital personnel (monthly)	2710.52	808.80	830.56	4176.05
Ln(Wage)	Natural log of wage	7.85	0.37	6.72	8.34
Subsidy per Bed Day	Average subsidy per bed day from government	1.08	4.35	0.00	20.60
Ln(Subsidy per Bed Day)	Natural log of subsidy per bed day	6.33	1.73	1.81	9.19
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	698.72	571.45	92.33	13.00
Ln(Illness Incidence)	Natural log of illness incidence	12.97	1.09	11.43	14.12
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	125.37	120.68	35.07	438.10
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	74.20	21.93	37.50	114.50
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	0.81	0.40	0.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	7181.40	17736.90	61.41	96417.50
Ln(Cost)	Natural log of total cost	14.40	1.63	11.03	18.38
Household Expenditures	Average annual household expenditures in municipality	34997.72	15705.93	5024.89	57243.81

Number of Observations = 32

Total operating cost is obtained by summing up the indicated expenses for personnel, surgical/medical supplies, drugs, water, light and power, depreciation, interest, rental, transportation and communication, repairs and maintenance, and "others." From Table 12A, total cost of sampled government hospitals had a minimum of P1.17 million and a maximum of P85.63 million for the whole year 1991. Private hospitals had a minimum of P61,408.00 and a maximum of P96.42 million.

Average wage is equal to the ratio of total wages and salaries for full-time personnel per month to the total medical and non-medical full-time personnel. The mean monthly wage among government hospitals amounted to P3,545.67 in 1991, with a minimum of P801.00 and a maximum of P5580.00. Private hospital employees had a mean monthly wage of P2,710.52 with a minimum of P830.00 and a maximum of P4,176.00.

Beds refer to actual number of beds (as against authorized bed capacity). The smallest of the sampled government hospitals had a bed capacity of only 10 beds while the largest had 390 beds. The smallest private hospital in the sample had 7 beds; the largest had 246. The presence of X-ray/Ecg/ ultrasound/ CT scan/ MRI machine used in generating the dummy variable Equipment was taken directly from the survey. About 85 percent of the sampled government hospitals and 81 percent of the private samples had at least one of these equipment. .

The case mix variable is simply the ratio of patients admitted in the Surgery Department patients to total patients. Although primary hospitals normally do not have departmentalized medical units (they are not required by the Bureau of Licensing and Regulations), their Surgery sub-unit was considered in this study as a department. On the average, government and private facilties treated 8.68 percent and 8.96 percent, respectively, of their admissions in Surgery.

The average insurance co-payment or support value for the hospital's insured patients was estimated by dividing total reimbursements from Medicare, HMO and other insurance schemes by the total number of insured patients. The resulting computed figures for government was P1,666.34; private hospitals had P1,486.59. With regards to the insurance coverage of patients (the ratio of insured discharges to total discharges), government hospitals posted an average of 17.51 percent, with actual values ranging from 1.45 percent to 56.00 percent. Among the sampled private hospitals, the mean was registered at 48.15 percent, with a minimum of 9.39 percent and maximum of 100 percent.

Finally, the subsidy per bed-day given to the hospitals is simply the ratio of total subsidy from the national and local governments divided by total bed-days, where the latter is just the product of total actual bed capacity and 365 (days). Among

government hospitals, the values ranged from P22.21 to P847.39. The amounts computed for private hospitals went from zero subsidy to P20.59.

The second set of data used in the regressions pertained to the catchment area or market: catchment population, other hospitals' bed capacity, average out-patient fee, average physician fee per admission, average consultation fees of out-patient clinics, average household expenditures, and average fee per out-patient visit in the municipality . These were taken from various sources. The catchment population is proxied in this study by the total number of persons with health complaint/s. This was computed by multiplying the rates (per hundred) of health complaint incidence obtained in the PIDS-DOH Household Survey (1993) by the total population of the province taken from the 1990 Census of Population of Housing and Statistics of the NSO. The first survey which was conducted in the second half of 1992 had as reference period for the health complaint questions the last four weeks immediately preceding the interview period. "Health complaint" refers to any physical discomfort felt by household members. As shown in Tables 12A and 12B, the average catchment population of government hospitals is 320,098; for private hospitals, this statistic stood at 698,721.

Data on the bed capacity of other hospitals in the municipality were taken from the 1991 BLR Masterlist of Hospitals. Unlike the beds data taken from the PIDS-DOH Hospital Survey, however, beds in the former refer to the authorized bed capacity. As presented also in Tables 12A and 12B, total beds of hospitals adjacent to our sampled government hospitals averaged at 543; those contiguous to private hospitals averaged at 1,952.

The municipal averages of physician fees per in-patient admission were processed from data culled from the PIDS-DOH Out-patient Clinics' (OPC) Survey. Fees in this survey were quoted depending on the type of patient accommodation (suite, private, pay ward and charity). A weighted average was then computed, where the weights used are the sample hospitals' actual distribution of patients by accommodation[6]. Since these weights differed from hospital to hospital, the obtained average physician fee tagged to the hospitals located in the same municipality also varied accordingly. The computed average physician fee tagged to government hospitals is P700.48; for private hospitals, this stood at P1,804.04.

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[6] Since the OPC survey did not have quotations for semi-private room patients, this study assumed that such patients were charged the same rates as those admitted in the private room category.

Consultation fees charged by out-patient clinics were also also culled from the OPC Survey; averages for each municipality were computed and tagged to hospitals found in the same municipality. The means of this variable for the sampled government and private hospitals are P52.37 and P74.19, respectively.

Household expenditures taken from the PIDS-DOH Households Survey were given on a weekly basis; for our regressions, these were converted to annual levels by straightforward multiplication of the given response by 52 (weeks). Averages by municipality were computed and tagged to the hospitals found in that locality. The mean of the computed expenditures linked to our government and private hospitals data are P21,315.14 and P34,997.72, respectively.

Lastly, the average hospital out-patient fees prevailing in the provinces were estimated from figures on hospital out-patient revenues and out-patient visits given in the Hospital Administrators Survey. Mean provincial OPD fees in the government hospital regressions were estimated at P75.96; for the private hospital regressions, this stood at 125.37.

V. Results from Econometric Estimations

A. Cost functions

Two alternative specifications of the Cobb-Douglas functions were regressed; the first set includes the Equipment variable as additional proxy measure for the hospital's capacity while the second set excludes this. Both specifications were followed for the two sample groups of hospitals; however, Table 13 presents the results of the models where Equipment is included in the private hospital regression but excluded in the government hospital regression only[7]. These are also the results consistent with the demand functions (and instrumental variable estimates of prices) presented in the succeeding sections of this chapter.

Application of the Chow test shows that the two sets of regressions differ with respect to all parameters. In other words, government and private hospitals exhibit significantly different cost functions[8]. The results suggests that while the operating cost of government hospitals vary significantly with both in-patient load and out-patient contacts, the latter outputs do not seem to matter in private hospitals. A plausible explanation is that OP

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[7] Although the two alternative specifications did not result in much variation in the estimated parameters of the government cost function itself, the one which excludes Equipment as a regressor is preferred since this is consistent with theoretically agreeable estimates of the demand and price function parameters which were estimated simultaneously along with the cost function.

[8] The Chow test was performed on the first-stage(IV) price functions where the F-statistic for the discharge fee is given by:

$$\frac{[\ SSR(constrained) - SSR(government) - SSR(private)]/12}{[\ SSR(government) + SSR(private)/\ 41}$$

where SSR = sum of squared residuals. (See Appendix E for SSR of the constrained price regression). The obtained statistic for the fee per discharge is 32.18 which is significant at 1 percent level of significance. The computed F-stat for the out-patient visit is 2.66, significant at 5 percent level of significance.

Table 13

Cobb-Douglas Cost Functions of Government and Private Hospitals

Dependent Variable: Ln(Total Cost)

Independent Variables	Government	Private
Constant	5.8646 (2.0294) *	10.0276 (1.2929)
Ln(Total in-patient discharges)	1.1048 (3.2047) *	1.2557 (2.4861) *
Ln(Total out-patient visits)	0.3598 (2.1104) *	-3.0618 (-1.9764)
Ln(Average wage per hospital personnel) (monthly)	-0.1447 (-0.5318)	1.8477 (2.6746) *
Ln(Total number of hospital beds)	-0.3336 (-0.9670)	1.5339 (2.4278) *
Surgical patients (%)	0.8309 (0.3610)	-4.9820 (-1.4646)
Equipment		1.9397 (1.6362)
R-squared	0.8494	0.8448
Number of observations	33	32

departments of private hospitals are used primarily not as treatment centers but as referral points for physicians whose clinics are also located in the same building as the hospital. Government hospitals do not normally house separate private physician clinics so that all out-patients have to be treated in their out-patient units[9].

Specifically, while a percent change in the number of out-patient contacts of government facilities increases their cost by .36 percent, private hospital costs remain unchanged with the number of OPD visits. The implied marginal cost (MC) of an OP visit in a government visit is given by:

$$\text{MC (government OP visit)} = .36\ C/K$$
$$= .36\ D^{1.10}\ K^{-.64}\ e^{5.86}$$

Since the marginal cost as given above is a decreasing function of the volume of OP visits, this suggests that OP units of government hospitals are utilized below their most efficient level.

With regard to the effects of in-patient services, while a percent change in the number of discharges in government facilities brings a 1.10 percent change in operating cost, a similar change in private hospitals expands their total cost by 1.25 percent. The derived marginal costs (MC) of in-patient discharges (IPD) are given by:

$$\text{MC (government IPD)} = 1.10\ C/D$$
$$= 1.10\ D^{.10}\ K^{.36}\ e^{5.86}$$

$$\text{MC (private IPD)} = 1.25\ C/D$$
$$= 1.25\ D^{.25}\ W1.85\ B^{1.53}$$

where e = 2.7182;

[9] Exceptions to these would be the autonomous government hospitals, i.e., National Children's Hospital (Lungsod ng Kabataan), Heart Center, Lung Center and the National Kidney Institute.

The table below presents the computed marginal costs of the two services for government and private hospitals[10]:

Table 14.
Estimated marginal costs of
government and private hospital services (in P)

	Discharge	Out-patient contact
Government	3014.71	221.84
Private	1458.91	0.00

The larger cost for a discharge in the government sector despite the higher elasticities obtained in the private sector is traced to the larger total operating costs (denoted by C in the formula) incurred in government hospitals. In turn, the marginal cost of a discharge is an increasing function of total discharges. Hence it may be surmised that the marginal cost pattern shown here is due to the larger in-patient load of government hospitals relative to private hospitals.

From Table 13, we also note that variations in input prices or in hospital bed size do not seem to explain some of the cost variations observed in the government sector. The latter would be expected if the government appropriates meager resources for repairs and maintenance of fixed assets. With regard to wages, our specification assumes that hospital personnel are variable inputs; others may argue, however, that these should be regarded as fixed assets in view of Civil Service rules regarding security of tenure, etc.

The same variables come out significantly in the private sector regression : a 1 percent increase in average wage triggers a 1.84 percent operating cost while a 1 percent additional bed capacity also pushes operating cost by 1.53 percent. The latter result implies that private hospitals may be overcapitalized, i.e., their capital stock may be too large given their output level (Magstaff and Barnum, 1992). The literature on hospital investments

[10] The values of C and D used in the estimation are the antilogs of the mean values of lnC and lnD.

in the U.S. (e.g., Joskow) suggests that this pattern could be expected from an industry where non-price competition is prevalent. Hospitals, for example, may invest in larger capacities to improve their so-called "reservation quality," i.e. their capability to shorten patients' waiting time especially during emergency, and consequently enhance their admission rate. This is somewhat corroborated by the results of our regressions for private hospital discharges and out-patient visits: having larger bed capacity has greater incremental effects on the flow of patients in both out-patient and in-patient departments as compared to the effects of price reductions (see also below).

3. Demand for in-patient care

Table 15 presents the estimated parameters of the discharge functions for government and private facilities. Our main interest here are the coefficients of the price variables. The private hospital regression exhibits the theoretically expected sign - a one-peso change in the discharge fee decreases total discharge by .0003 percent. However, the government hospital regression shows a contrary behavior - higher priced hospitals have higher discharges, other things held constant. A peso increase in the discharge fee leads to an increase in in-patient load by 0.003 percent. This outcome is likely to happen if higher prices in government hospitals were taken as signals for higher quality, e.g., availability of drugs, medical supplies or diagnostics. (A proxy measure of these may be found in the dummy variable for equipment which also appears as a regressor; but this is insignificant probably due to the lumping of basic equipment such as X-ray with more advanced CT Scan).

Private hospital admissions are also responsive to out-patient fee charges of the hospital : a peso increase in the latter reduces admissions by 1.4 percent. In other words, private hospitals may induce hospital admissions by reducing their out-patient fees. This result does not show up in the government hospital regression where the coefficient of the OPD fee is not signficantly different from zero.

Nevertheless, government hospital admissions respond negatively, albeit very slightly, to another price variable, the doctor's fee. A percentage increase in physician fees in the municipality (weighted by the type of hospital admissions) brings about a decline of .40 percent in government admissions. The negative relationship supports the notion that hospitals serve as workshops of physicians, the latter being the gatekeeper or the agent who finally determines whether patients could purchase hospital services (Pauly and Redisch, 1973). Furthermore, given that government-employed physicians are not supposed to charge their patients, the regression result seems to suggest that government hospitals are in effect open-staffed facilities, i.e.,

Table 15
Demand for Government and Private Hospital In-Patient Care

Dependent Variable: Ln(Total Discharges)

Independent Variables	Government	Private
Constant	8.2696 (7.2731) *	7.0656 (2.0401)
Fee per discharge	0.0032 (4.1094) *	-0.0003 (-2.5805) *
Ln(Illness incidence in province)	0.2004 (2.6778) *	-0.1454 (-0.4050)
Bed capacity of other hospitals in municipality	-0.0002 (-3.5049) *	-0.0001 (-1.2416)
Total number of hospital beds	0.0126 (6.1179) *	0.0213 (4.6984) *
Ln(Doctors average fee)	-0.3999 (-2.3849) *	0.0478 (0.0844)
Ln(Support value per insured patient)	-0.3344 (-4.9149) *	0.3591 (3.0097) *
Fee per out-patient visit	0.0095 (1.1244)	-0.0143 (-2.7932) *
Equipment	0.3188 (1.3572)	0.8914 (1.3993)
Average household expenditures	7.7623E-08 (-0.8900)	5.7071E-08 (0.2994)
R-squared	0.8550	0.6822
Number of observations	33	32

these are also used as work settings of private or fee-charging physicians. On the other hand, private hospital admissions seem unresponsive to physician fee patterns but this could be due to the significant collinearity between this variable and hospital fees (See Appendix D). If private hospitals are also owned by physicians, hospital bills could likely include professional fees.

The insurance variables (support value per insured patient) appear to influence the pattern of both government and private hospital discharges, but at opposite directions. While a percentage increase in the support value pushes private discharges by .36 percent, this pulls down government discharges by .33 percent. Possibly, an increase in the support value enables insured patients in a private hospital to purchase more diagnostics and medicine since they are now less sensitive to prices. This, in turn, could facilitate shorter lengths of stay, consequently allowing the hospital to treat a greater number of cases. The dampening effect of insurance support on government facilities on the other hand will be expected if this allows the insured to purchase longer days of stay. Though they may also be less sensitive to the prices of diagnostics and drugs, perhaps the absence or shortage of these services in government facilities does not allow them the opportunity to avail shorter lenghts of stay in the same way as the private hospital users.

Another important difference between the two provider groups has to do with the effect of the size of their catchment population. In the government model, a percentage increase in the provincial incidence of health complaints is occasioned by a .20 percent surge in discharges. Private hospitals, however, do not seem to respond to the same variable; alternative runs where the catchment area was limited to the municipality where the facility itself is located showed similar results. Seemingly, approximating the size of the catchment area of private facilities by its geopolitical boundaries as practiced in the government licensure system may not be appropriate[11]. It is also possible that "health

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[11] The DOH - BLR defines a facility's catchment area depending on the level of development of the area where the hospital is located (urban vs. rural) and the category of hospital care as follows:

	Urban	Rural
Primary	15 km. radius or one urban district	4 municipalities close to the site of establishment
Secondary	25 km.radius or one city	district where hospital is located

needs" as measured here is not an important determinant in the utilization of private facilities; if so, only market factors are relevant in rationing private hospital services.

The presence of other hospital facilities in the catchment area appears to crowd-out patients from government facilities, although at very low rates : an increase in the number of neighboring hospital beds exerts a .0002 percent reduction in dicharges for the whole year. The regression for the private hospital discharges show on the other hand that these are invariant with the size of neighboring hospitals; however, this may be due to the significant collinearity between this variable and the discharge fee.

As expected, both regressions indicate that hospital size or bed capacity has the most substantial impact on the volume of discharges. An additional bed in private facilities brings about an increase of .02 percent of total discharges or 31 patients. In government facilities, the incremental effect is lower (percentage wise) at .012 percent, but almost the same in terms of the absolute count (33 patients). The other indicator of capacity (the dummy for the presence of equipment) is insignificant in both regressions, probably due to multicollinearity problems. As bed capacity expands, it is most likely that provision of services "around the bed" including diagnostic equipment also follows.

C. Demand for out-patient care

Results of the out-patient visit regressions are presented in Table 16. Seemingly, out-patient care services of both government and private facilities contract when their own prices increase, although at lesser rates than the rate in the price change. Raising the OP fee by 1 percentage exerts a reduction in the volume of private and government hospital OP visits by .89 percent and .76 percent respectively[12].

Similar to the results obtained in the discharge regressions, OP visits in government facilities also move with the provincial incidence of health complaints but at a much higher rate as

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Tertiary hospitals	one city and one contiguous municipality	one province

[12] The figures are obtained by multiplying the coefficients of OP fee in Table 15 by the mean OP fee in Tables 12A and 12B.

Table 16
Demand for Government and Private Hospital Out-Patient Care

Dependent Variable: Ln(Out-Patient Visit)

Independent Variables	Government	Private
Constant	2.7782	10.0709
	(1.3040)	(5.8889) *
Fee per discharge	0.0016	-1.4641E-05
	(2.1126) *	(-0.3534)
Ln(Illness incidence in province)	0.5007	-0.0898
	(3.2375) *	(-0.4938)
Average out-patient fee per province	-0.0026	-0.0013
	(-0.8554)	(-1.9553)
Total number of hospital beds	0.0043	0.0084
	(0.9175)	(2.7387) *
Ln(Doctors average fee)	0.0441	-0.1039
	(0.1248)	(-0.3667)
Fee per out-patient visit	-0.0421	-0.0074
	(-2.1442) *	(-2.3552) *
Equipment	0.6792	1.1573
	(1.4218)	(2.4348) *
Average household expenditures	4.7716E-09	1.5516E-08
	(0.0300)	(0.1617)
R-squared	0.7742	0.2949
Number of observations	33	32

expected. A percentage change in the incidence pushes the volume of visits by 0.5 percent. On the other hand, OP visits to private facilities also manifest the same picture in the discharge regression : these are also seemingly unresponsive to health complaint incidence.

The size of the facility as measured by the number of beds and the presence of equipment does not significantly influence the pattern of OP visits in government facilities unlike in the private hospital sector where their separate or combined effects even exceed the price effect. Given this suggestion of demand inducement, our earlier result regarding the overcapitalization of private facilities should be expected.

In both sets of regressions, the prevailing OP price in the province has no significant influence on OP visits, suggesting the presence of "captive" markets for both government and private facilities. However, price may be a poor indicator of competition since as cited earlier, non-price features of private hospitals such as bed size matter more in determining the flow of out-patients.

The discharge fees of government hospitals also impacts signficantly on the number of OP visits, albeit at a very small rate of .0016 percent for every peso increase in the in-patient fee. In other words, government facility users would rather opt to take use of the out-patient units when charges for in-patient care rises. But, this does not hold true for private facilities.

The seemingly insignificant impact of physician fees on OP visits to government and private facilities is most likely caused by its correlation with the discharge fee which also appears on the right hand side of the equation.

D. Price equations

Given the parameters obtained from the cost and demand functions (and after further simplification), the profit-maximizing fee equations for discharges (P_d^*) and OP visit (P_k^*) are as follows:

Government:

$$P_d^* = 1.102\ C/D - 310.59 - 13.25/D$$
$$= 1.102\ D^{.10}\ K^{.36}\ e^{5.86} - 310.59 - 13.25/D$$

$$Pk^* = .36\ C/K + 23.73$$
$$= .36\ D^{1.10}\ K^{-.64}\ e^{5.86} - 23.73$$

Private :

$$P_d^* = 1.25\ C/D + 3448.28$$
$$= 1.25\ D^{.25}\ W^{1.85}\ B^{1.53}$$

$$P_k^* = 135.30 - 3283.2\ D/K + 2.42\ C/K$$
$$= 135.30 - 3283.2\ D/K + 2.42\ (D^{1.25}\ W^{1.85}\ B^{1.53})/K$$

In-patient fees in government and private hospitals rise with expansions in the level of discharges. Government hospital fees also change postively with the number of OP visits. In contrast, OP fees in both sectors are negative functions of the volume of OP visits. (Although the marginal cost of an OP visit in private hospitals is zero, changes in D and K affect its fee due to the effects of OP fees on D). Private OP fee may, however, rise with the volume of OP visits if the numerator in the second term (3283.2 D) is greater than the numerator in the third term.

Table 17 shows the computed average profit-maximizing fees and their underlying "composition." (These figures were computed based on the means of the included variables[13]). Also shown are the actual average fees, and the average subsidy. The latter is computed by simply getting the difference between the actual average fee and the estimated profit-maximizing fee.

As shown, the computed average discharge fee in the private and government sectors is much lower than their profit-maximizing levels. The actual fees in government and private hospitals make up only 6.8 and 35 percent, respectively, of the profit-maximizing levels. Comparing these to the marginal costs of the service, government prices recover only about 7.13 percent of the former. In contrast, private facilities are priced 16 percent above their actual marginal cost. In other words, private hospitals appear to earn profits but not as much as they would have if they fully took advantage of their market power.

For OP visits, the average government facility likewise charges only 7.8 percent of the income-maximizing level. The average private facility, if it followed the profit-maximizing pricing scheme, should have subsidized OP visits to generate more in-patient discharges. The actual fee, however, is positive; in view of their pricing for in-patients, this suggests the possibility that private hospitals have perhaps overcharged OP services to compensate for the relatively lower profits derived from in-patient services.

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[13] The antilog of the mean of Ln(discharges) and Ln(OP visits) were used instead of the mean of the variables themselves in evaluating the price components.

Table 17. Breakdown of Actual Private and Government Hospitals Fees (in P)

	Fee Per Unit of Service	Net Income Maximizing Fee	Marginal Cos of Service	Profit Maximizing Mark-up	Marginal Cost Net of Marginal Revenue of the Other Service	Discount From Profit-Max Price	Total Subsidy to Patient
	[1] = [2] - [6]	[2] = [3] + [4] + [5]	[3]	[4]	[5]	[6]	[7] = [6] - [4]
A. In-Patient Discharge							
Private	1692.38	4907.19	1458.91	3448.28	0	3214.80	-233.48
Government	214.77	3185.14	3014.71	-310.59	481.01	2970.37	3280.96
B. Out-Patient Contact							
Private	128.43	-18.89	0	135.3	-154.19	-147.32	-282.62
Government	19.16	245.57	221.84	23.73	0	226.41	202.68

In sum, comparison of the actual profit-maximizing fees and the actual fees allows us to trace the source of variation between government and private hospital prices.

Table 18
Private - government fee disparity
(in P)

	IP	OP
Total difference	1447.61	109.27
Due to marginal cost	- 1555.80	- 221.84
Due to pure mark-up	3758.87	111.57
Others	- 481.01	- 153.99
Due to discount/subsidy policy	244.43	- 373.73

The negative sign of figures above the last line in the table imply that government fees due to that particular source are higher; otherwise they are lower. A positive difference due to the subsidy policy means that private subsidies are higher; otherwise they are lower. In essence, much of the private-government price variation for in-patient services is due to the ability of privately-owned facilities to extract mark-ups; their subsidy policy attributable to their concern for the health of their catchment area mitigates this tendency to a large extent. Subject to the limitations of our data set - the reported fees may have been lower than the actual charges - the estimates shown above also suggests that seemingly, the average amount of subsidy extended by private hospitals for IP care purely due to the public health consideration is larger than that of government hospitals. In contrast, "additional" mark-ups charged in private facilities further exacerbate the private-government disparity in OP fees.

E. Effects of cost and demand determinants on hospital fees

(a) Bed capacity

Given the parameters obtained from the empirical cost and demand equations, the marginal effects of the significant determinants of hospital cost and demand on fees are estimated. As shown in Table 19, the larger the hospital in terms of its bed capacity, the higher are its charges for both IP and OP care. As discussed earlier, the impact on private hospitals is much larger since marginal costs are directly affected by it, perhaps due the

Table 19
Marginal Effects of Cost and Demand Determinants on Hospital Fees (P)

Determinants	Fee per Discharge		Fee per Out-Patient Contact	
	Government	Private	Government	Private
Average Wage (Peso)	0	1.05	0	0.68
Bed Capacity	3.99	72.90	2.16	50.94
Insurance Support Value (P)	-0.22	0.76	-0.08	0.29
Insurance Coverage of Patients (%)	-4.72	98.21	0	0
Incidence of health complaints in province	0.04	0	-0.01	0
Bed capacity of other hospitals in municipality	-0.07	0	-0.04	0
Average weighted fee of physicians per in-patient visit in municipality	-0.22	0	0.03	0
Equipment	0	0	0	-209.42
Average out-patient fee in province	0	0	0	0
Average household expenditure in province	0	0	0	0

larger current or variable costs that expansion entails. Furthermore and as discussed earlier, additional beds in private facilities induce greater marginal demand than additional beds in government facilities. It could be that larger capacity serves as a better signal for better quality in the private sector than in the other sector.

(b) Wages

Increases in hospital personnel wages are absorbed by both IP and OP care patients of private facilities. The estimates even suggest that the resulting IP fee increases are even bigger than the wage increases. OP visits are more expensive by 68 centavos for every P1 wage hike. In contrast, government fees remain invariant with changes in the salary scales of hospital personnel.

(c) Insurance

The impact of insurance schemes depends on the amount of reimbursement or support value, and on the enrollment or coverage rate of the hospital in-patients. Moreover, as shown in the government sector, the impact also depends on the role of higher prices in inducing demand. While a 1 percent increase in the coverage rate is occasioned by an increase in the average in-patient fee of P98.21 in the private sector, this brings in a slight reduction of P4.72 in the other sector. In other words, more insured patients bolsters the ability of private facilities to earn larger profit-maximizing mark-ups; in the government sector, this in effect allows government patients to enjoy greater subsidy. In essence, government hospital in-patients receive subsidies from two sources - the insurance agency (particularly Medicare) through the insured patient, and the national government[14]. Corollarily, an increase in the insurance coverage of hospital users improves the accesibility of Medicare funds to government facilities.

Furthermore, higher reimbursements to the hospital per insured patient also has an inflationary effect on private sector prices but a deflationary effect on government prices. The underlying reasons for these opposite impact were discussed in earlier sections; but, this would be better understood by breaking down the effects of this variable. Higher reimbursement or support value not only shifts the demand for hospital care as shown in Table 15, but

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[14] Note that this result hinged on the demand-inducing role of prices on discharges (see Table 16). If demand for government in-patient services were negatively related to prices, the effect of greater insurance coverage would be similar to that obtained in the private sector.

it also makes demand more inelastic[15]. The demand curve not only shifts; it would also become steeper. The latter implies that, holding discharges at the equilibrium level prior to insurance, profit-maximizing prices will be higher by an amount equal to the increase in the mark-up. Thus, the inflationary effect of an increase in the support value comes from two sources : (a) an increase in the marginal cost brought about by the shift in the demand curve; and (b) an increase in the mark-up due to the change in the slope of the demand curve.

Table 20 below shows estimates of the magnitude of each component of the price change due to a higher insurance support value :

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[15] The empirical support for this could be obtained by including an interaction variable for the insurance support value and the fee per discharge on the right hand side of our demand functions. However, this resulted in multicollinearity problems. An alternative method that was resorted to involves simulating the change in the elasticity by : (a) formulating the mark-up as an explicit function of the support rate and the insurance coverage following the discussion in the analytical framework of this paper; (b) getting the derivative of the mark-up with respect to the support rate ; (c) evaluate the derivative obtained in (b) at the mean values of the support rate and insurance coverage.

The mark-up is equal to 1/X where X, given our functional specification, is equal to $\partial \ln D/\partial P_d$. The estimated value of the latter from the regression is also equal to $(\partial \ln D/\partial P_d)^{\circ}$ ($1 - \sigma\delta$), where the superscript o denotes the value prior to insurance, δ is the support rate, and σ is the coverage rate. Given the estimated mark-ups and the mean vaules of σ and δ, we can generate $(\partial \ln D/\partial P_d)^{\circ}$ by simply multiplying the estimated mark-up by $(1 - \sigma\delta)$. The computed values for the private and government hospitals are : -.0005 for the private sector and -.0089 for the government sector.

The derivative of the mark-up with respect to the support rate is equal to $1/\delta^2\sigma Y$, where $Y=(\partial \ln D/\partial Pd)^{\circ}$; the derivative with respect to the coverage rate is equal to $1/\sigma^2\delta Y$.

Table 20
Breakdown of the Marginal Effect of
Insurance Support Value on Hospital Discharge Fee

	Government	Private
Total marginal effect	-.22 (100%)	.76 (100%)
Due to increase in marginal cost	-.17 (77%)	.45 (59 %)
Due to increase in mark-up	-.0496 (23%)	.313 (41 %)

Marginal cost is lower in the government sector since our demand function indicates that this shifts downward with higher support values. Likewise, subsidy per discharge increases since this has a similar effect as that of increasing the coverage rate. The price reduction due to the latter is however smaller compared to the reductions in marginal cost. Note also that since the marginal cost of an OP visit is also affected positively by the number of discharges, the average OP fee is also dampened although by a very low amount.

In the private sector, almost half of the price increase for IP care induced by higher insurance reimbursements is attributable to increases in the mark-ups. The upward shift in IP care also pushes marginal cost, and consequently the average fee by 76 cents for every peso hike in the support value. Likewise, fees for OP visits are also affected due to the cross price effects.

(d) Incidence of health complaints

Only the demand for government hospital services shifts upward as the provincial incidence of health complaints escalates. Consequently, only their prices respond to this variable. An increase of the incidence by 1000 pushes the marginal cost and price by only 40 pesos. In contrast, since government OP units are utilized below their most efficient level, a similar increase results in a decline in OP fee by 10 pesos.

(e) Bed capacity of other hospitals

The crowding-out effect of additional bed capacity in

neighboring hospitals leads to small reductions in government fees amounting to 7 centavos per in-patient, and 1 centavo per OP contact. No such effect is estimated in the private sector as utilization in this sector seems unaffected by the presence of competing providers.

(f) Professional fees

A peso increase in the professional fees of physicians for IP care dampens the utilization of IP units in government facilities, thereby lowering average price by 22 centavos; the OP fee, however, rises slightly by 3 centavos.

(g) Presence of equipment

Since private OP fees decline with greater utilization of their OP units, the presence of demand-inducing equipment has a dampening effect on OP prices. Holding other things constant, hospitals with an X-ray or Ecg or ultra-sound or CT-Scan or an IMR have OP fees that are lower by P210 on the average compared to other private hospitals.

(h) Other determinants

Contrary to expectations, hospital prices in catchment areas with higher income (as proxied by household expenditures) are not at all different from those prevailing in poorer areas. This pattern is found in both government and private sectors.

Finally, hospital fees also seem insensitive to the prevailing OP fees in other facilities, suggesting the absence of price competition among facilities.

VI. Implications of Empirical Results on Government Hospital Pricing and Policies on Third-Party Schemes

A. Government pricing

Recent discussions on what may be done to improve the financial viability of hospitals devolved to local government units have considered the possibility of privatizing the user fee schemes in these facilities. The results in this study give some general indications on (a) the average increase in prices depending on the objective of the new pricing policy (i.e. to recover marginal cost or to maximize net profit); (b) the effects of alternative pricing scheme on the level of utilization of these facilities. The simulations reported here are limited to the extent that our empirical model from which the parameters are derived is based on pre-devolution data on hospitals. These facilities were required to remit all revenues from user fees to the Treasury, except for some fees from the sale of drugs which are retained in the hospital as part of the revolving fund for drugs. The simulations here do not capture the possible effects of revenue retention and allocation on hospital utilization. Table 21 shows the average fee per IP discharge and OP visit under three alternative pricing regimes, and their implied utilization levels.

Table 21. Utilization of Government IP and OP Services Under Alternative Pricing Regimes

	In-patient		Out-patient	
	Fee per Discharge (P)	Total Discharges	Fee per OP visit (P)	Total OP visits
Subsidized pricing	214.77	2646.01	19.16	1168.13
Marginal cost pricing	3014.71	26499.70	221.84	-30500.37
Net-income pricing	3185.14	27951.66	245.57	-39307.76

Due to the peculiar role of prices in inducing more government IP discharges, higher user fees implied by a shift to either marginal cost pricing or net-income maximizing pricing regime will

lead to an expansion in the number of patients treated. As discussed earlier, patients when charged at higher fees are likely to decrease their lengths of stay, hence allowing government facilities to attend to more IP users. Retention of revenues at the facility level and their eventual use for the purchase of diagnostic and therapeutic supplies and equipment could facilitate the substitution of these throughputs for longer bed-stays.

However, a switch to either marginal cost pricing or net-income maximizing regime will jeopardize the utilization of OP units in view of the negative relationship between their prices and utilization[16]. All these imply that if the government's objective is to maximize utilization of both OP and IP units at the same time it will have to adopt a mixed strategy where IP care is priced at the net-income maximizing level while current, subsididzed OP care pricing is maintained. Under this scenario, IP discharges per hospital will reach 27,952 while OP visits will average at 68,047.

Apart from the pricing scheme, the model here suggests that improvements in the utilization of government IP units could also be achieved by investing in more beds; but this does not seem tenable in the face of low appropriations for capital expenditures and the currently low utilization/occupancy rate of existing beds. Moreover, the effects of beds in the regression perhaps capture the availability of more supplies and other equipment in higher-capacity hospitals offering more advanced level of care.

Reductions in professional fees charged by physicians practicing in government facilities could also redound to higher utilization. Unfortunately, private physician pricing practices are outside the purview of government policy or even if they are, this could be extremely difficult to police. Limiting the number of hospitals or the capacity expansion of existing facilities in the catchment area could also alleviate utilization. However, the results in this model cannot be of much help in distinguishing which sector (government or private) should be curbed.

B. Third-party schemes

The results summarized in Table 15 indicate, however, that higher insurance support from Medicare and/or other schemes for IP patients could mitigate the effects of adopting marginal cost or income-maximizing prices on government utilization as measured by the number of discharges. But it is surmised that this could largely be due to the absence or shortage of diagnostics and other

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[16] The estimates on the number of OP visits under the marginal cost and net income-maximizing pricing regimes incorporate the cross-price effects of changes in the IP fees.

non-bed throughputs for IP care which could have been purchased by IP users to shorten their stay. If this is indeeed the case, then it may be inappropriate for government facilities to receive larger insurance support without a concurrent improvement in the supply of non-bed throughputs. Otherwise, larger Medicare support would only result in lower IP discharges.

On the other hand, improving the third-party support for or expanding the insurance coverage of hospital users enhances the ability of private facilities to strenghten their market power and improve their mark-ups. This is ironic considering that a similar simulation done for the private hospitals suggests that policies that would encourage private hospitals towards competetive pricing (where price is equal to marginal cost) would yield the most efficient level of utilization (See Table 22).

Table 22. Utilization of Private IP and OP Services Under Alternative Pricing Regimes

	In-patient		Out-patient	
	Fee per Discharge (P)	Total Discharges	Fee per OP visit (P)	Total OP visits
Subsidized pricing	1692.38	1535.38	128.43	4569.27
Marginal cost pricing	1458.91	1639.28	0	8677.09
Net-income pricing	4907.19	98.52	120.09	4836.02

C. Some caveats

This study attempted to distinguish the pricing decisions of government and private hospitals as well as the determinants of their utilization. However, the interaction of both sectors was not explicitly modelled, specifically the effects of government pricing on private hospital prices and vice-versa. The demand models in this paper took into account, however, the capacity of <u>all</u> other hospitals (government and private) in the province so that public and private interaction can be indirectly inferred but not in terms of prices. That is, the coefficient of "other beds" in the government demand equation already captures the effect of private hospital capacity within the same province; the same also applies to the private hospital demand equation.

In addition, this study, in reckoning the effects of hospital pricing, insurance schemes, etc. this study was limited to the

narrow concept of utilization as measured by the number of discharges and OP visits. Higher insurance support values shift the demand for private IP care but such shifts may not necessarily translate to improvements in the health status of the catchment area. Our attempt to extend our empirical model to capture the effects of hospital services on the latter is severely limited by the lack of data on indicators such as the incidence of ill health requiring hospitalization in the catchment area. Moreover, availability of this type of data would have also allowed us to test whether the rate or amount of subsidies for IP and OP care extended by hospitals in areas with greater health needs are larger.

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PROVINCE	Total Number of Hospitals	Total Authorized Bed Capacity	PRIMARY		SECONDARY		TERTIARY	
			Number	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity
REGION 1								
ILOCOS NORTE	6	205	2	30	3	75	1	100
ILOCOS SUR	7	300			6	200	1	100
LA UNION	7	365	1	15	4	100	2	250
PANGASINAN	10	720	3	45	4	175	3	500
REGION 2								
BATANES	2	100			2	100		
CAGAYAN	14	748	5	73	8	275	1	400
ISABELA	11	405	4	55	6	250	1	100
NUEVA VIZCAYA	4	300			3	100	1	200
QUIRINO	4	160	1	10	2	50	1	100
REGION 3								
BATAAN	6	340	1	15	3	75	2	250
BULACAN	8	600			7	400	1	200
NUEVA ECIJA	14	880	4	75	8	355	2	450
PAMPANGA	14	720			13	470	1	250
TARLAC	5	390	1	15	3	175	1	200
ZAMBALES	4	240			3	90	1	150
REGION 4								
BATANGAS	9	610	1	15	6	345	2	250
CAVITE	9	370	6	70	2	150	1	150
LAGUNA	10	505	4	80	4	175	2	250
MARINDUQUE	2	125			1	25	1	100
OCC. MINDORO	1	100					1	100
OR. MINDORO	4	155	2	30	1	25	1	100
PALAWAN	9	785	3	40	6	745		
QUEZON	8	405	2	30	5	175	1	200
RIZAL	5	250	2	25	3	225		
ROMBLON	1	100					1	100

PROVINCE	Total Number of Hospitals	Total Authorized Bed Capacity	PRIMARY		SECONDARY		TERTIARY	
			Number	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity
REGION 5								
ALBAY	8	335	1	10	6	175	1	150
CAMARINES NORTE	3	140	1	15	1	25	1	100
CAMARINES SUR	10	821	6	271	3	100	1	450
CATANDUANES	8	400	2	25	5	175	1	200
MASBATE	7	210	3	35	3	75	1	100
SORSOGON	8	240	3	40	4	100	1	100
REGION 6								
AKLAN	7	200	4	50	2	50	1	100
ANTIQUE	8	235	3	35	4	100	1	100
CAPIZ	8	260	3	35	3	100	2	125
GUIMARAS	2	40	1	15	1	25		
ILOILO	15	1245			12	695	3	550
NEGROS OCC.	10	735	1	10	7	250	2	475
REGION 7								
BOHOL	11	492	5	92	3	75	3	325
NEGROS ORIENTAL	7	440	1	15	5	175	1	250
SIQUIJOR	2	115	1	15			1	100
CEBU	21	2045	7	120	12	1375	2	550
REGION 8								
LEYTE	13	910	2	35	8	400	3	475
BILIRAN SUB-PROV.	4	55	2	20	2	35		
SOUTHERN LEYTE	7	255	2	20	4	135	1	100
EASTERN SAMAR	11	300	5	50	5	150	1	100
NORTHERN SAMAR	8	325			7	225	1	100
SAMAR	5	235	1	10	3	125	1	100

PROVINCE	Total Number of Hospitals	Total Authorized Bed Capacity	PRIMARY		SECONDARY		TERTIARY	
			Number	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity
REGION 9								
BASILAN	2	50			2	50		
SULU	9	440	3	140	5	200	1	100
TAWI-TAWI	4	110	2	35	2	75		
ZAMBOANGA DEL NORTE	8	280	3	30	5	250		
ZAMBOANGA DEL SUR	14	1085	7	510	4	175	3	400
REGION 10								
AGUSAN DEL NORTE	5	325			3	75	2	250
AGUSAN DEL SUR	5	195	3	45	1	50	1	100
BUKIDNON	5	175	3	50	1	25	1	100
CAMIGUIN	3	140	1	15	2	125		
MISAMIS OCCIDENTAL	6	325	2	25	2	100	2	200
MISAMIS ORIENTAL	10	580	4	55	5	325	1	200
SURIGAO DEL NORTE	9	445	4	45	4	250	1	150
REGION 11								
DAVAO DEL NORTE	4	225			3	75	1	150
DAVAO ORIENTAL	4	150	2	25	1	25	1	100
DAVAO DEL SUR	7	540	3	40	2	50	2	450
SOUTH COTABATO	8	295	4	45	2	50	2	200
SURIGAO DEL SUR	7	225	2	25	4	100	1	100
REGION 12								
LANAO DEL NORTE	5	325			3	150	2	175
LANAO DEL SUR	5	95	2	20	3	75		
MAGUINDANAO	6	585	2	260	3	125	1	200
NORTH COTABATO	5	145	2	20	3	125		
SULTAN KUDARAT	4	100	2	25	2	75		

PROVINCE	Total Number of Hospitals	Total Authorized Bed Capacity	PRIMARY		SECONDARY		TERTIARY	
			Number	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity
NCR								
MANILA	7	3477					7	3477
QUEZON CITY	14	5970	1	50			13	5920
CALOOCAN CITY	3	2140			1	25	2	2115
RIZAL, M.M.	14	6500	1	25	7	875	6	5600
VALENZUELA	1	25			1	25		
CAR								
ABRA	5	165	3	40	1	25	1	100
BENGUET	6	550	2	25	2	75	2	450
IFUGAO	5	175			5	175		
KALINGA APAYAO	10	340	1	15	9	325		
MT. PROVINCE	5	250			4	150	1	100

Appendix A2. Distribution of Private Hospitals and Beds by Province and Level of Care

PROVINCE	Total Number of Hospital	Total Authorized Bed Capacity	PRIMARY		SECONDARY		TERTIARY	
			Number	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity
REGION 1								
ILOCOS NORTE	8	147	4	43	4	104		
ILOCOS SUR	17	302	9	119	8	183		
LA UNION	9	316	6	68	1	12	2	236
PANGASINAN	32	959	19	245	9	334	4	380
REGION 2								
BATANES								
CAGAYAN	16	240	10	100	6	140		
ISABELA	24	395	19	225	4	70	1	100
NUEVA VIZCAYA	2	28	1	10	1	18		
QUIRINO								
REGION 3								
BATAAN	6	87	3	24	3	63		
BULACAN	42	729	12	123	29	556	1	50
NUEVA ECIJA	4	30	4	30				
PAMPANGA	36	902	19	202	11	270	6	430
TARLAC	14	344	9	99	2	45	3	200
ZAMBALES	12	219	6	102	6	117		
REGION 4								
BATANGAS	37	945	12	144	21	451	4	350
CAVITE	18	517	9	95	5	112	4	310
LAGUNA	28	871	10	111	12	345	6	415
MARINDUQUE	1	25			1	25		
OCC. MINDORO								
OR. MINDORO	8	147	2	21	6	126		
PALAWAN	6	113	2	21	4	92		
QUEZON	11	590	3	35	4	186	4	369
RIZAL	20	438	13	162	6	126	1	150
ROMBLON								

PROVINCE	Number of Hospital	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity
REGION 5								
ALBAY	40	777	27	345	9	207	4	225
CAMARINES NORTE	8	185	4	50	3	85	1	50
CAMARINES SUR	21	545	12	160	6	190	3	195
CATANDUANES	1	10	1	10				
MASBATE	16	260	12	132	4	128		
SORSOGON	8	118	6	76	2	42		
REGION 6								
AKLAN	3	95			2	45	1	50
ANTIQUE	1	25			1	25		
CAPIZ	3	210	1	10			2	200
GUIMARAS								
ILOILO	5	626	2	26			3	600
NEGROS OCC.	18	861	10	142	4	155	4	564
REGION 7								
BOHOL	20	609	10	207	8	303	2	99
NEGROS ORIENTAL	4	208	2	23			2	185
SIQUIJOR								
CEBU	25	1718	8	122	7	225	10	1371
REGION 8								
LEYTE	9	338	3	32	4	81	2	225
BILIRAN SUB-PROV.								
SOUTHERN LEYTE	4	110	3	60	1	50		
EASTERN SAMAR	5	114	2	34	3	80		
NORTHERN SAMAR	3	51	1	14	2	37		
SAMAR	4	46	2	16	2	30		

PROVINCE	Total Number of Hospital	Total Authorized Bed Capacity	PRIMARY Number	PRIMARY Authorized Bed Capacity	SECONDARY Number	SECONDARY Authorized Bed Capacity	TERTIARY Number	TERTIARY Authorized Bed Capacity
REGION 9								
BASILAN	5	141	1	10	4	131		
SULU								
TAWI-TAWI	1	12	1	12				
ZAMBOANGA DEL NORTE	9	238	6	88	3	150		
ZAMBOANGA DEL SUR	34	542	25	313	7	129	2	100
REGION 10								
AGUSAN DEL NORTE	14	466	9	166	3	140	2	160
AGUSAN DEL SUR	7	78	7	78				
BUKIDNON	37	730	27	358	9	277	1	95
CAMIGUIN								
MISAMIS OCCIDENTAL	30	767	23	476	6	191	1	100
MISAMIS ORIENTAL	13	426	5	52	5	154	3	220
SURIGAO DEL NORTE	3	60	1	15	2	45		
REGION 11								
DAVAO DEL NORTE	50	983	47	883	3	100		
DAVAO ORIENTAL	4	83	4	83				
DAVAO DEL SUR	71	2530	57	1379	10	566	4	565
SOUTH COTABATO	20	654	14	189	2	100	4	365
SURIGAO DEL SUR	13	387	8	167	4	125	1	95
REGION 12								
LANAO DEL NORTE	15	446	9	151	3	100	3	195
LANAO DEL SUR	3	115			3	115		
MAGUINDANAO	8	276	5	121	2	55	1	100
NORTH COTABATO	44	995	34	601	10	394		
SULTAN KUDARAT	23	539	19	277	2	88	2	174

PROVINCE	Total Number of Hospital	Total Authorized Bed Capacity	PRIMARY		SECONDARY		TERTIARY	
			Number	Authorized Bed Capacity	Number	Authorized Bed Capacity	Number	Authorized Bed Capacity
NCR								
MANILA	27	3158	1	20	9	280	17	2858
QUEZON CITY	24	2109	5	132	10	369	9	1608
CALOOCAN CITY	10	358	5	64	4	74	1	220
RIZAL, M.M.	49	2729	14	137	24	777	11	1815
VALENZUELA	6	332	3	32	2	50	1	250
CAR								
ABRA	11	278	7	117	4	161		
BENGUET	12	470	6	140	5	187	1	143
IFUGAO	2	26	2	26				
KALINGA APAYAO	5	91	3	44	2	47		
MT. PROVINCE	2	40	1	10	1	30		

Appendix B. Descriptive Statistics of Sampled Government Hospitals in Regions 2, 7, 10 and NCR per Province

Table B1. Bohol

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	225.44	96.34	76.94	336.10
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	36.23	39.66	6.71	98.47
Total Discharges	Total in-patient discharges	3560.67	3821.48	1006.00	10999.00
Out-Patient Visits	Total out-patient visits	17392.50	26336.38	786.00	70128.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	534.30	206.59	396.67	922.79
Wage	Average wage per hospital personnel (monthly)	3530.24	632.53	2748.48	4387.79
Beds	Total number of hospital beds	67.67	76.00	10.00	220.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	108.00	175.22	0.00	413.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	680.76	576.88	116.77	1661.99
Insured Patients	Ratio of insured discharge to total discharges	0.29	0.16	0.13	0.56
Surgical Patients	Ratio of surgery department discharges to total discharges	0.08	0.06	0.00	0.19
Subsidy per Bed Day	Average subsidy per bed day from government	387.86	222.34	22.21	631.58
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	149.69	0.00	149.69	149.69

Table B1. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Averge of out-patient fee per visit in province	107.46	0.00	107.46	107.46
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	60.33	11.36	53.00	75.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	0.83	0.41	0.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	10290.80	10650.80	1287.98	30209.00
Household Expenditures	Average annual household expenditures in municipality	21318.83	18086.56	5601.14	44454.47

Number of observations = 1

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per discharge	Average fee per in-patient discharge	207.93	220.78	42.79	678.25
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	8.97	5.21	0.00	14.25
Total Discharges	Total in-patient discharges	2932.00	3255.79	1125.00	10235.00
Out-Patient Visits	Total out-patient visits	16121.14	18428.05	4450.00	56617.00
Doctors Fee	Average fee of physicians in municipality where hospita is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	325.28	0.74	325.00	326.95
Wage	Average wage per hospital personnel (monthly)	3542.69	506.04	3094.48	4513.38
Beds	Total number of hospital beds	55.00	65.57	10.00	200.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	66.71	101.85	0.00	288.00
Insurance Support	Average reimbursement from insurance schemes inclu Medicare per insured discharge	5233.35	10222.05	95.75	28189.75
Insured Patients	Ratio of insured discharge to total discharges	0.10	0.08	0.01	0.23
Surgical Patients	Ratio of surgery department discharges to total dischar	0.09	0.09	0.00	0.26
Subsidy per Bed Day	Average subsidy per bed day from government	466.85	122.27	302.15	603.07
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	92.33	0.00	92.33	92.33

Table B2. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Averge of out-patient fee per visit in province	37.68	0.00	37.68	37.68
Doctors Consultation Fee	Average consultation fee charged by physicians in mun where clinic is located	44.46	9.41	37.50	58.75
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	0.86	0.38	0.00	1.00
Total Cost	Total operating cost (in Thousand)	7346.39	8390.40	1086.22	25760.90
Household Expenditures	Average annual household expenditures in municipality	18709.91	10054.15	11794.25	35121.09

Number of observations = 6

Table B3. Cebu

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	104.99	59.16	37.95	181.48
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	11.91	17.75	0.00	44.72
Total Discharges	Total in-patient discharges	2129.67	1144.26	961.00	3860.00
Out-Patient Visits	Total out-patient visits	14604.50	6763.29	7460.00	26549.00
Doctors Fee	Average fee of physicians in municipality where hospital is located,weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	341.95	154.75	275.00	657.44
Wage	Average wage per hospital personnel (monthly)	3297.49	1520.98	801.74	5580.96
Beds	Total number of hospital beds	32.50	15.73	10.00	50.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	4.17	6.65	0.00	15.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	870.70	593.48	112.33	1807.12
Insured Patients	Ratio of insured discharge to total discharges	0.09	0.08	0.01	0.24
Surgical Patients	Ratio of surgery department discharges to total discharges	0.07	0.05	0.00	0.13
Subsidy per Bed Day	Average subsidy per bed day from government	714.40	220.38	441.90	1056.97
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	494.55	0.00	494.55	494.55

Table B3. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximu
Provincial Out-Patient Fee	Averge of out-patient fee per visit in province	73.05	0.00	73.05	73.05
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	27.50	9.35	20.00	45.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan / MRI	0.67	0.52	0.00	1.00
Total Cost	Total operating cost (in Thousand)	7963.01	4158.56	3895.42	15820.10
Household Expenditures	Average annual household expenditures in municipality	16693.54	3513.85	13699.63	22644.14

Number of observations = 6

Table B4. N C R

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	329.33	174.58	135.07	500.43
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	15.33	20.20	0.31	45.15
Total Discharges	Total in-patient discharges	9711.50	5537.53	2628.00	16103.00
Out-Patient Visits	Total out-patient visits	63578.50	31356.36	30598.00	104038.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	1909.01	311.85	1559.47	2183.90
Wage	Average wage per hospital personnel (monthly)	4540.17	474.87	4256.48	5250.54
Beds	Total number of hospital beds	218.50	135.59	82.00	390.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	3899.50	3705.41	40.00	7689.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	1257.96	1265.30	139.82	2881.77
Insured Patients	Ratio of insured discharge to total discharges	0.10	0.07	0.03	0.19
Surgical Patients	Ratio of surgery department discharges to total discharges	0.15	0.04	0.11	0.19
Subsidy per Bed Day	Average subsidy per bed day from government	493.31	268.35	236.00	847.39
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	1359.90	0.00	1359.90	1359.90

Table B4. N C R

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	329.33	174.58	135.07	500.43
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	15.33	20.20	0.31	45.15
Total Discharges	Total in-patient discharges	9711.50	5537.53	2628.00	16103.00
Out-Patient Visits	Total out-patient visits	63578.50	31356.36	30598.00	104038.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	1909.01	311.85	1559.47	2183.90
Wage	Average wage per hospital personnel (monthly)	4540.17	474.87	4256.48	5250.54
Beds	Total number of hospital beds	218.50	135.59	82.00	390.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	3899.50	3705.41	40.00	7689.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	1257.96	1265.30	139.82	2881.77
Insured Patients	Ratio of insured discharge to total discharges	0.10	0.07	0.03	0.19
Surgical Patients	Ratio of surgery department discharges to total discharges	0.15	0.04	0.11	0.19
Subsidy per Bed Day	Average subsidy per bed day from government	493.31	268.35	236.00	847.39
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	1359.90	0.00	1359.90	1359.90

Table B4. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Averge of out-patient fee per visit in province	217.30	173.89	68.50	438.10
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	94.63	19.64	67.50	114.50
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	1.00	0.00	1.00	1.00
Total Cost	Total operating cost (in Thousand)	35737.70	35544.90	7649.99	85630.30
Household Expenditures	Average annual household expenditures in municipality	53518.49	4364.56	48888.67	57243.80

Number of observations = 4

Table B5. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Averge of out-patient fee per visit in province	51.14	0.00	51.14	51.14
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	58.50	20.79	35.00	76.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or or CT scan /MRI	0.75	0.50	0.00	1.00
Total Cost	Total operating cost (in Thousand)	13670.90	15515.60	1594.01	36260.60
Household Expenditures	Average annual household expenditures in municipality	19660.58	6042.09	13186.73	24808.51

Number of observations = 4

Table B6. Quirino Province

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	83.33	52.95	31.53	137.36
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	7.21	8.10	1.59	16.50
Total Discharges	Total in-patient discharges	2663.00	2029.89	943.00	4902.00
Out-Patient Visits	Total out-patient visits	4983.67	2234.57	2531.00	6904.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigled by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	325.00	0.00	325.00	325.00
Wage	Average wage per hospital personnel (monthly)	3815.02	399.65	3463.16	4249.54
Beds	Total number of hospital beds	46.67	46.36	16.00	100.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	0.33	0.58	0.00	1.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	742.88	962.81	105.14	1850.40
Insured Patients	Ratio of insured discharge to total discharges	0.14	0.10	0.02	0.21
Surgical Patients	Ratio of surgery department discharges to total discharges	0.06	0.06	0.01	0.12
Subsidy per Bed Day	Average subsidy per bed day from government	342.68	127.26	196.81	431.00
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	22.97	0.00	22.97	22.97

Table B6. Quirino Province

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	7.21	0.00	7.21	7.21
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	33.33	14.43	25.00	50.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	1.00	0.00	1.00	1.00
Total Cost	Total operating cost (in Thousand)	6608.21	7323.73	1173.23	14936.60
Household Expenditures	Average annual household expenditures in municipality	17993.31	6646.56	10543.87	23316.80

Number of observations = 3

Table B7. Surigao Del Norte

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	222.59	90.96	116.88	352.20
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	20.49	26.64	2.14	67.27
Total Discharges	Total in-patient discharges	2777.20	2861.25	578.00	7592.00
Out -Patient Visits	Total out-patient visits	12552.00	16858.78	1767.00	42391.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	851.63	3.82	844.80	853.33
Wage	Average wage per hospital personnel (monthly)	2977.04	1008.69	1214.08	3743.89
Beds	Total number of hospital beds	64.00	56.25	10.00	150.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	13.40	26.23	0.00	60.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	824.55	520.94	251.83	1458.87
Insured Patients	Ratio of insured discharge to total discharges	0.26	0.11	0.14	0.39
Surgical Patients	Ratio of surgery department discharges to total discharges	0.07	0.04	0.03	0.14
Subsidy per Bed Day	Average subsidy per bed day from government	366.74	137.62	252.83	568.09
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	98.15	17.28	67.24	105.88

Table B7. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Averge of out-patient fee per visit in province	35.07	0.00	35.07	35.07
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	52.00	0.00	52.00	52.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	0.60	0.55	0.00	1.00
Total Cost	Total operating cost (in Thousand)	9196.49	112980.00	1583.69	28838.00
Household Expenditures	Average annual household expenditures in municipality	8659.13	8366.98	3122.60	21970.26

Number of observations = 5

Appendix C. Descriptive Statistics of Sampled Private Hospitals in Regions 2, 7, 10 and NCR by Province

Table C1. Bohol

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	694.89	398.37	329.37	1222.41
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	129.52	114.98	17.67	255.79
Total Discharges	Total in-patient discharges	2318.50	1120.55	900.00	3469.00
Out-Patient Visits	Total out-patient visits	4917.00	4665.95	759.00	11333.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private/ private, suite)	701.27	137.87	583.33	882.80
Wage	Average wage per hospital personnel (monthly)	2048.75	285.88	1707.69	2332.73
Beds	Total number of hospital beds	32.50	8.66	25.00	40.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	242.00	204.58	33.00	425.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	627.73	394.84	325.05	1207.32
Insured Patients	Ratio of insured discharge to total discharges	0.84	0.12	0.70	0.99
Surgical Patients	Ratio of surgery department discharges to total discharges	0.02	0.01	0.01	0.04
Subsidy per Bed Day	Average subsidy per bed day from government	0.00	0.00	0.00	0.00
Iliness Incidence	Total number of persons with health complaint in the province (in Thousand)	149.69	0.00	149.69	149.69

Table C1. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	107.46	0.00	107.46	107.46
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	64.00	12.70	53.00	75.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	1.00	0.00	1.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	1265.06	438.03	613.00	1558.53
Household Expenditures	Average annual household expenditures in municipality	26913.85	20486.99	5601.14	44454.47

Number of observations =

Table C2. Cagayan

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	383.78	238.54	104.87	643.53
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	85.04	55.83	36.25	163.74
Total Discharges	Total in-patient discharges	736.50	553.75	303.00	1473.00
Out-Patient Visits	Total out-patient visits	3293.75	1109.63	1989.00	4593.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	604.39	166.19	367.55	720.00
Wage	Average wage per hospital personnel (monthly)	2110.76	1066.62	830.56	3433.33
Beds	Total number of hospital beds	17.25	6.40	9.00	24.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	156.50	211.20	0.00	464.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	431.89	460.29	149.53	1119.96
Insured Patients	Ratio of insured discharge to total discharges	0.60	0.34	0.14	0.89
Surgical Patients	Ratio of surgery department discharges to total discharges	0.02	0.02	0.00	0.03
Subsidy per Bed Day	Average subsidy per bed day from government	0.00	0.00	0.00	0.00
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	92.33	0.00	92.33	92.33

Table C2. Cagayan

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	37.68	0.00	37.68	37.68
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	48.44	11.24	37.50	58.75
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan / MRI	0.25	0.50	0.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	444.18	548.10	61.41	1256.64
Household Expenditures	Average annual household expenditures in municipality	23896.66	10884.66	13139.29	35121.10

Number of observations = 4

Table C3. Cebu

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	3966.60	3538.42	147.62	8333.61
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	175.44	95.06	18.48	261.96
Total Discharges	Total in-patient discharges	6883.67	6250.94	1088.00	14356.00
Out-Patient Visits	Total out-patient visits	10740.00	6100.07	5420.00	21609.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	1259.16	364.08	533.50	1516.02
Wage	Average wage per hospital personnel (monthly)	3407.70	509.21	2767.86	4176.05
Beds	Total number of hospital beds	116.67	99.44	20.00	246.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	1341.17	713.01	5.00	1838.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	3508.11	3869.23	67.99	9845.51
Insured Patients	Ratio of insured discharge to total discharges	0.40	0.30	0.19	1.00
Surgical Patients	Ratio of surgery department discharges to total discharges	0.13	0.07	0.06	0.24
Subsidy per Bed Day	Average subsidy per bed day from government	60056.00	147106.56	0.00	360336.00
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	494.45	0.00	494.45	494.45

Table C3. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	73.05	0.00	73.05	73.05
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	72.50	15.92	40.00	79.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan / MRI	0.83	0.41	0.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	23538.10	37201.90	722.38	96417.50
Household Expenditures	Average annual household expenditures in municipality	27030.50	10780.50	5024.89	31431.62

Number of Observations = 6

Table C4. National Capital Region

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	1763.41	1724.10	17.50	6625.00
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	137.34	94.03	1.81	309.12
Total Discharges	Total in-patient discharges	1906.21	1899.97	120.00	5872.00
Out-Patient Visits	Total out-patient visits	7587.86	8836.29	703.00	35040.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	2971.69	641.64	1414.50	3946.82
Wage	Average wage per hospital personnel (monthly)	2856.25	741.77	1072.05	3668.88
Beds	Total number of hospital beds	44.29	40.19	7.00	150.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	3717.00	3121.01	159.00	8057.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	1312.04	1327.81	0.00	4074.53
Insured Patients	Ratio of insured discharge to total discharges	0.34	0.32	0.00	1.00
Surgical Patients	Ratio of surgery department discharges to total discharges	0.12	0.10	0.00	0.25
Subsidy per Bed Day	Average subsidy per bed day from government	0.00	0.00	0.00	0.00
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	1359.90	0.00	1359.90	1359.90

Table C4. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	202.99	149.31	68.50	438.10
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	87.86	21.26	52.00	114.50
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	1.00	0.00	1.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	5559.22	7389.36	151.80	26245.60
Household Expenditures	Average annual household expenditures in municipality	49965.11	7973.13	32826.92	57243.81

Number of observations = 14

Table C5. Misamis Oriental

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	674.94	559.94	185.84	1174.54
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	64.04	30.95	33.21	93.17
Total Discharges	Total in-patient discharges	2092.25	369.79	1614.00	2515.00
Out-Patient Visits	Total out-patient visits	6295.75	6186.33	1242.00	13881.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	1356.62	279.98	1120.76	1736.90
Wage	Average wage per hospital personnel (monthly)	2427.59	702.04	1444.89	3102.44
Beds	Total number of hospital beds	22.00	5.72	14.00	27.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	536.25	357.55	0.00	723.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	726.34	830.93	71.44	1881.91
Insured Patients	Ratio of insured discharge to total discharges	0.51	0.08	0.41	0.60
Surgical Patients	Ratio of surgery department discharge to total discharges	0.06	0.03	0.02	0.09
Subsidy per Bed Day	Average subsidy per bed day from government	41349.25	82698.50	0.00	165397.00
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	159.78	0.00	159.78	159.78

Table C5. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	51.14	0.00	51.14	51.14
Doctors Consultation Fee Fee	Average consultation fee charged by physicians in municipality where clinic is located	68.75	14.50	47.00	76.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan \MRI	0.50	0.58	0.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	1006.14	1142.69	260.95	2708.71
Household Expenditures	Average annual household expenditures in municipality	22566.03	4484.96	15838.59	24808.51

Number of observations = 4

Table C6. Surigao Del Norte

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Fee per Discharge	Average fee per in-patient discharge	612.78	0.00	612.78	612.78
Fee per Out-Patient Visit	Average revenue of hospital per out-patient visit	156.93	0.00	156.93	156.93
Total Discharges	Total in-patient discharges	1643.00	0.00	1643.00	1643.00
Out-Patient Visits	Total out-patient visits	3500.00	0.00	3500.00	3500.00
Doctors Fee	Average fee of physicians in municipality where hospital is located, weigted by type of hospital admissions (e.g. charity, payward, semi-private / private, suite)	1109.51	0.00	1109.51	1109.51
Wage	Average wage per hospital personnel (monthly)	3037.88	0.00	3037.88	3037.88
Beds	Total number of hospital beds	20.00	0.00	20.00	20.00
Other Hospital Beds	Total beds of other hospitals in the same municipality	190.00	0.00	190.00	190.00
Insurance Support	Average reimbursement from insurance schemes including Medicare per insured discharge	1009.90	0.00	1009.90	1009.90
Insured Patients	Ratio of insured discharge to total discharges	0.39	0.00	0.39	0.39
Surgical Patients	Ratio of surgery department discharges to total discharges	0.02	0.00	0.02	0.02
Subsidy per Bed Day	Average subsidy per bed day from government	0.00	0.00	0.00	0.00
Illness Incidence	Total number of persons with health complaint in the province (in Thousand)	105.88	0.00	105.88	105.88

Table C6. (continued)

Variables	Description	Mean	St. Dev.	Minimum	Maximum
Provincial Out-Patient Fee	Average of out-patient fee per visit in province	35.07	0.00	35.07	35.07
Doctors Consultation Fee	Average consultation fee charged by physicians in municipality where clinic is located	52.00	0.00	52.00	52.00
Equipment	1 if hospital has X-ray or Ultrasound or ECG machine or CT scan /MRI	1.00	0.00	1.00	1.00
Total Cost	Total operating cost (in Thousand pesos)	1885.53	0.00	1885.53	1885.53
Household Expenditures	Average annual household expenditures in municipality	21970.26	0.00	21970.26	21970.26

Number of observations = 5

Appendix D1. Instrumental Variable Estimates of Government and Privat Hospital Fee Per Discharge

Dependent Variable: Fee per discharge

Independent Variables	Government		Private	
Constant	-8.6683		-2340.1100	
	(-0.0942)		(-3.4375)	*
Doctors average fee	0.2392		1.4899	
	(4.3072)	*	(5.1138)	*
Average wage per hospital personnel	-0.0178		0.0781	
	(-1.0368)		(0.4487)	
Total number of hospital beds	0.3866		19.9769	
	(0.9357)		(6.9611)	*
Bed capacity of other hospitals in municipality	0.0022		-0.3460	
	(0.1337)		(-4.8929)	*
Support value per insured patient	0.0192		0.8002	
	(6.8587)	*	(11.5502)	*
Subsidy per bed day	0.4756		-9.6884	
	(4.5673)	*	(-0.2676)	
Ln(Illness incidence in province)	-0.0003		-0.0004	
	(-4.1914)	*	(-0.8773)	
Equipment	-90.0041		271.0670	
	(-2.0954)	*	(0.6565)	
Average household expenditures	4.490740E-05		-1.7660E-05	
	(2.6033)	*	(-0.1416)	
Surgical patients (%)	-614.3000		-10326.9000	
	(-1.6165)		(-4.7031)	*
Insured patients (%)	-83.7229		1461.3300	
	(-0.6795)		(2.7929)	*
R squared	0.6272		0.9090	
Number of observations	33		32	

Appendix D2. Instrumental Variable Estimates of Government and Priv Hospital Fee Per Out- Patient Visit :

Dependent Variable: Fee per out-patient visit

Independent Variables	Government	Private
Constant	21.8191	231.0630
	(1.5179)	(3.4564) *
Doctors average fee	-0.0087	0.0357
	(-0.5715)	(1.4211)
Average wage per hospital personnel	-0.0020	-0.0204
	(-0.8650)	(-1.5227)
Total number of hospital beds	-0.1684	0.8111
	(-2.2642) *	(3.0121) *
Average out-patient fee in the province	0.0036	0.0761
	(0.0558)	(0.6935)
Subsidy per bed day	-0.0217	-5.7043
	(-1.2882)	(-2.1553) *
Illness incidence in the province	0.0000	0.0000
	(0.1105)	(0.1894)
Equipment	-1.0576	14.7079
	(-0.1024)	(0.3807)
Average household expenditures	6.2863E-06	-4.3403E-06
	(1.6259)	(-0.3537)
Surgical patients (%)	-62.5835	-67.5956
	(-1.1620)	(-0.4265)
Doctors consultation fee	0.4962	-2.0597
	(2.1784) *	(-2.5947) *
R squared	0.2575	0.3338
Number of observations	33	32

Hospital Investment Patterns:

A Baseline Study

Hospital Investment Patterns : A Baseline Study

Ma. Socorro V. Zingapan[1]

I. Introduction

Capital expenditures generally constitute a small portion of government health spending in most developing countries. Of their total health budget, capital outlays for health by selected governments in Asia in the second half of the 80s ranged from only 4 percent in Papua New Guinea to 35 percent in Korea (see Griffin, 1992). In the Philippines, this ratio averaged at 9 percent during the period 1988-91, a large part of which was channelled to government hospitals (Lanuza and Manalo, 1994). Recent major policies, mainly the devolution of facilities to local government units and the shift in the prioritization of national government health resources from personal care to community health care, are expected to bring about some reductions in the overall public spending for capital in the hospital sector.

Nevertheless, investment in hospital facilities has been of interest to policymakers who are motivated primarily by concerns regarding potential demand shifts occasioned by expansions in the coverage of the Medicare program as well as as those arising from population growth and changing epidemiological patterns. In the past, the main policy response to these was direct investment in new and existing government in-patient facilities. During the initial years of implementing the Medicare program in the 70s, a total of 81 10-bed community hospitals and health centers were specifically built to provide for the needs of the enrollees in the program (Griffin and Paqueo, 1987). But, as policymakers attempt to desist from resorting to the same type of intervention, alternative schemes will have to be considered. Consequently, the responsiveness of facilities in the private sector to the above-cited external factors becomes more important.

The second motivation is drawn from the experiences of other countries with extensive health insurance programs where monitoring of hospital investment is primarily fuelled by concerns regarding its consequences on medical charges. The general notion is that insurance, specifically in the U.S. system, has predisposed hospitals to over-invest in so-called prestige technologies or

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expensive diagnostic and therapeutic equipment as well as amenities. Consequently, the rising fixed cost of patient care has been pointed out as a major factor in medical price escalations in the U.S. (Feldstein, 1981). In the Philippines, however, it is alleged that Medicare has engendered the growth of smaller-sized facilities (that is, primary care hospitals) but has not encouraged capital expansion because of the lower support rates given to users of facilities offering higher levels of care (see Griffin, et. al., 1992).

Another driving motivation for examining hospital investment has to do with the inter-facing among hospitals in the market. At the Department of Health, concerns over tendencies to "over-expand" in certain areas have led to licensure policies that tied up the establishment of new facilities or expansion of existing ones to the overall bed supply in a catchment area. The basic policy is to disallow further establishment of facilities if the hospital bed supply- to- population ratios in a catchment area exceed some specified ratio. This policy implicitly assumes that facilities crowdout each other from providing hospital care. But, to the extent that hospitals in the catchment area in fact provide complementary services, crowding-in could occur. Thus, varying interaction patterns may be obtained.

This baseline study aims:

(1) to provide a profile of the types of hospital investment by ownership and type of care of hospital, their average magnitude and how these were financed; and

(2) to examine the determinants of the following aspects of hospital investment behavior: (a) likelihood of a hospital to invest; (b) level of capital expenditures; (c) hospital bed size; and (d) likelihood of acquiring a short list of equipment that includes the most basic (X-ray and ECG machine) and the relatively advanced (ultrasound, MRI and CT Scan).

In particular, we are interested in the effects on the pattern of hospital investment of the following factors : (a) insurance (that is, Medicare and private schemes); (b) ownership, to the extent that public and private hospitals operate under different incentive schemes; (c) location, to the extent that demographic, epidemiologic and socio-economic characteristics vary from province to province; and (d) market structure or more specifically the capacity of other government and private providers in the catchment area.

Hospital investment is comprised of construction of new hospital facilities or the expansion or maintenance of existing capacities. The study is, however, limited to the latter only since time series data on new hospital construction and other relevant

riables are not available. Moreover, time and data constraints limit us to investigate the capital spending of sampled facilities a single year only (1991).

The second section of this report presents some stylized facts hospital investment culled from the DOH-PIDS Hospital dministrators Survey with three subsections : (a) hospital vestment by category and ownership of facility; (b) types of vestment ; and (c) investment by location of facility. The third ection presents a review of literature and discusses a theoretical ramework for analyzing hospital investment. The fourth section ives the specification, data and results of the econometric stimation of the 1991 capital expenditures of sampled hospitals. he fifth section presents and analyzes the results of analyses on ospital bed capacity and the likelihood of having acquired X-ray, CG machine, ultrasound, MRI or CT Scan. The final section ummarizes the results and highlights some policy implications.

II. Hospital Investment Patterns : Some Stylized Facts

The main source of data used in this study is the 1993 OH-PIDS Hospital Administrators Survey which covered in 1991 the peration of 159 hospitals in the provinces of Cagayan and Quirino Region 2), Cebu and Bohol (Region 7), Misamis Oriental and Surigao l Norte (Region 10) and the National Capital Region. The urposively sampled hospitals included government and private acilities providing primary, secondary and tertiary level of care. losely approximating the actual distribution of hospital acilities across provinces, our samples were divided by province s follows: Bohol - 9 percent; Cagayan - 11 percent; Cebu - 15 ercent; NCR - 48 percent; Misamis Oriental - 8 percent; Quirino - percent; and Surigao del Norte - 6 percent.

The presentation of data that follows aims to use two-way ables to identify issues or questions examined in the empirical del provided in succeeding sections. Since these tables abstract om the effects of other hospital determinants, the patterns they esent are merely suggestive and not conclusive.

1. Patterns of investment by ownership and level of care

<u>vestment by ownership of facility</u>. Hospital investment is ending devoted to increasing or maintaining the stock of hospital pital which consists of: (a) hospital building; (b) curative care eds; (c) diagnostic and other medical machines; (d) non-medical quipment; and (e) vehicles used in the delivery of services.

On the whole, only 57 percent of the sampled facilities in the

PIDS-DOH Hospital Survey incurred capital expenses in 1991. Figure 1 further depicts the number of hospitals with reported capital spending in at least one of the abovementioned categories, shown as a percentage ratio of the total number of sample hospitals, stratified by ownership and level of hospital care. Figure 2 gives the average amount of capital expenditures, stratified by the same categories.

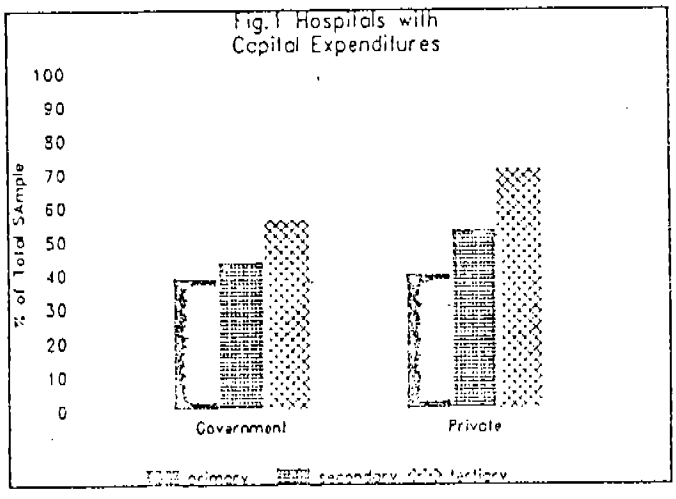
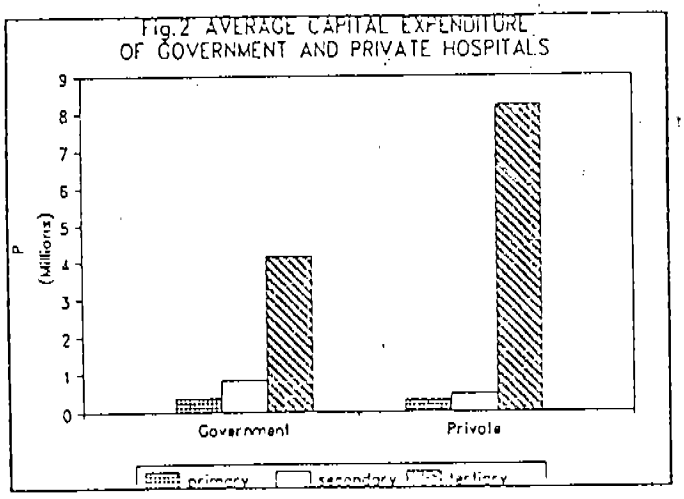


Figure 1 displays a generally higher percentage among the sampled private hospitals that reported some capital spending as compared to government-owned facilities. Forty (40) percent of the primary hospitals in the private sector reported an investment activity in 1991 versus 39 percent in government. Observed differences in the higher levels of care were greater : 53 percent of the sampled private secondary facilities compared to 43 percent in the government sector; and 71 percent of the sampled tertiary private hospitals versus 56 percent of their government counterpart.

The ratios in Figure 1 are higher as the probability of incurring capital expenses by hospitals increases. This leads us to pose the question on whether ownerhip affects the probability of incurring capital expenditures. Similarly, does ownership also play a role in determining the actual amount spent for capital? From Figure 2, average capital expenditures of private facilities providing primary and secondary care are seemingly lower compared to their counterpart in the government sector. Controlling for ownership, the average expenses of higher facilities are apparently greater.



Capital expenditures of primary hospitals in the government sector averaged at P.36 million as compared to P.29 million registered by private primary sector. Secondary government hospitals posted an average of P.8 million versus P.45 million by private secondary facilities. However, the pattern is reversed in the case of tertiary facilities : the government-owned facilities averaged P4.1 million, almost half of the average amount spent by those in the private sector (P8.2 million).

Sources of funds for investment. A number of investment determinants such as access to government subsidy, tax exemptions, internal savings or profits are related to the ownership of the facility. Government-owned facilities are expected to be more inclined to obtain support for capital expansion in the form of subsidies or tax exemptions since they have no access at all to their own savings which are reverted back to the National Treasury. In addition, their savings may be too meager or non-existent inasmuch as their user fees are not aimed to recover current costs or earn profits. In contrast, private hospitals are not constrained by external authorities in managing their financial operations; they can pursue the option of investing their savings or profits in physical capital instead of appropriating this in some other form such as higher salaries for their employees or higher earnings for their owners.

Indicative data supporting these observations are given below in Tables 1 and 2 showing the availment of government subsidies, tax exemptions, donations, borrowings and the utilization of internal savings by facilities to support their capital expansion:

Table 1 : Availment Rate of Financing Sources for Capital Expenditures by Government Hospitals in Selected Provinces
(% of Total Hospitals with Capital Expenditures in 1991)

Source of Financing	Primary Hospitals	Secondary Hospitals	Tertiary Hospitals
Direct government subsidy	83.33	88.89	100.00
Borrowings	0.00	0.00	0.00
Internal savings	0.00	0.00	0.00
Donations	16.67	0.00	16.67
Tax exemption	33.33	22.22	50.00

Source of basic data : PIDS-DOH Hospital Survey

Financial support for capital expenditures of most government hospitals in 1991, particularly those in the tertiary level came primarily from the national government and probably local authorities. These were in the form of direct transfers or subsidy and indirectly through tax exemptions. Direct transfers supported all tertiary hospitals, 89 percent of secondary facilities and 83 percent of primary facilities that incurred expenses for their infrastructure.

Tax exemptions were given to half of the investing tertiary facilities, 22 percent of the secondary facilities and 33 percent of the primary facilities. The low availment for tax exemptions as compared to direct transfers could have been due to the form of investment. While direct acquisition of imported equipment is eligible for tariff exemptions, repairs of machine and building construction are not inherently eligible. Equipment imported from other countries as direct purchases or donations are imposed tariff duties but, government facilities are exempt from this requirement (see NEDA Rules and Regulation Implementing the Last Clause of the Last Paragraph of Section 105 of Tariff and Customs Code as Amended). Note that direct acquisition of hospital equipment from the local market is, however, subjected to a 10 percent value added

tax.

Some primary and tertiary government hospitals also reported capital outlays that were funded by donors. But, none directly resorted to borrowings from banks and other lending agencies. The latter is not of course unexpected since (a) government hospitals have no authority to incur loans; and (b) central authorities who approve of the capital expenditures normally see to it that these are backed up by budgetary appropriations. Note, however, that national or local authorities may have also obtained portions of their transfers to facilities from lending institutions.

In contrast, Table 2 below shows that majority of private hospitals relied heavily on self-generated funds to support their capital expenses while none has reported any direct government assistance. Internal savings were used by 90 percent of all reporting tertiary private hospitals, 67 percent of all secondary hospitals and 71 percent of all primary hospitals:

Table 2 : Availment of Financing Sources for Capital Expenditures by Private Hospitals in Selected Provinces
(% of Total Hospitals with Capital Expenditures in 1991)

Source of Financing	Primary Hospitals	Secondary Hospitals	Tertiary Hospitals
Direct government subsidy	0.00	0.00	0.00
Borrowings	0.00	11.11	10.000
Internal savings	71.43	66.67	90.00
Donations	14.29	5.55	10.00
Tax exemption	0.00	11.11	0.00

Source of basic data : PMDS-DOH Hospital Survey

The utilization of internal savings by most private hospitals as compared to government hospitals may be traced to (a) the liberty to spend their own profits on capital expenditures; and (b) the lack of constraints in generating higher incomes from user fees. In connection with the second point, note from Appendix Table A.1 that government facility prices for in-patient and out-patient services were on average lower than charges of privately-owned

facilities.

Only a small segment of the private hospital sector - 11 percent of the sampled secondary hospitals - resorted to borrowings in backing-up their investment plan. This could have been caused by a low propensity to apply for such facility and/or high rejection rate by lending agencies. Propensities to borrow would depend, among others, on the interest charges. From the PIDS-DOH Survey, we gather that interest rates charged to the few hospitals which resorted to borrowings from banks and/or informal lenders, including relatives of owners, ranged from a minimum of 10 percent to a maximum of 27 percent.

Availment of tax exemptions was also extremely low; only 11.11 percent of secondary private hospitals were extended this type of assistance. Unfortunately, no information allows us to clarify whether this may be due to (a) inherent ineligibility of private hospital investments in 1991 for tax exemptions; or (b) rejection of applications for eligible investment; or (c) ignorance of providers regarding this facility. Under the NEDA rules on tariff payments for importations of private hospitals, only the primary and secondary hospitals are exempt from tariff duties while tertiary hospitals are mandated to do otherwise. (In contrast, all government hospitals regardless of category are qualified for exemption).

Investment pattern by level of hospital care. The second question that comes out from Figures 1 and 2 is : does the level of care also affect the probability of expanding one's facility and the amount of capital expenditures? Regardless of ownership, it seems that higher level hospitals have greater tendencies to invest. Their average expenditures are also seemingly larger.

The type of care offered by a facility is related to its size and its case mix, both of which could affect decisions to invest. Larger facilities are apt to have relatively large depreciated capital stock which provides an impetus to incur maintenance or replacement expenses. The case mix and diagnostic (or severity) mix of diseases in larger facilities are also more complicated; the required technology to provide the necessary medical protocols would consequently be more sophisticated and more expensive to maintain.

B. Types of hospital investment

Types of capital expenditures in 1991. Earlier in Figure 2, the average amount of capital expenditures was shown. Underlying the variation in these amounts would be the type of capital items that were actually acquired and/or maintained. As an example, acquisition of one bed would be less expensive than the acquisition

of a vehicle. Table 3 below shows the specific types of investment and the ratio of government hospitals that engaged therein :

Table 3:
Percentage of Government Hospitals in Selected Provinces with Capital Expenditures in 1991, by Type of Investment

Type of Capital Expenditures	Primary	Secondary	Tertiary
Medical equipment acquisition	22.22	22.73	50.00
Medical equipment repair	5.55	13.64	0.00
Beds acquisition/repair	11.11	4.54	18.75
Non-medical equipment acquisition	11.11	9.09	25.00
Non-medical equipment repair	5.55	13.64	6.25
Vehicle acquisition/repair	5.55	0.00	0.00
Building construction/ repair	5.55	9.09	18.75
Others	5.55	9.09	0.00

Source of basic data : PHDS-DOH Hospital Survey

The dominant type of investment activity among government facilities in 1991 was the acquisition and repair of medical equipment. This was particularly true for those in the tertiary level of which 50 percent had new medical apparatus. A lesser percentage among the lower level facilities acquired new medical apparatus. Appropriations for medical equipment repairs were reported by some primary and secondary hospitals but none among the tertiary providers.

Acquisition of non-medical equipment was the next most prevalent expenditure for tertiary government hospitals followed by acquisition and/or repairs of beds and building construction and/or repair. For secondary level facilities, repairs of office equipment appeared more frequently than acquisition of new ones and building renovation or expansion. Among the primary level hospitals, both these items came up at the same rate.

Echoing the overall picture shown earlier in Figure 1, private sector providers submitted higher rates of investment as

compared to the government sector in almost all types :

Table 4
Percentage of Private Hospitals in Selected Provinces with Capital Expenditures in 1991, by Type of Investment

Type of Capital Expenditures	Primary	Secondary	Tertiary
Medical equipment acquisition	21.74	26.47	41.67
Medical equipment repair	8.69	26.47	45.83
Beds acquisition/repair	8.69	11.77	16.67
Non-medical equipment acquisition	21.74	17.65	37.50
Non-medical equipment repair	13.04	14.71	25.00
Vehicle acquisition/repair	8.69	0.0	12.50
Building construction/ repair	4.34	11.77	16.67
Others	8.69	5.89	8.83

Source of basic data : PHDS-DOH Hospital Survey

Expenditures for the acquisition and repairs of medical equipment also emerged to be the most prevalent form of investment among private facilities, followed by non-medical equipment repairs/acquisition. Expenditures aimed at expanding or maintaining facility size - building construction/repairs and bed acquisition/ repairs - were submitted at lower rates.

In sum, investment patterns exhibited by government and private sector facilities in 1991 suggest their seeming preference for improving the quality of existing capacities by spending for repairs and acquiring new medical apparatus. A fewer number engaged in building repairs/construction and bed expansion. Fewer hospitals reported investment in non-medical items such as office administration.

Bed capacity and equipment profile of hospitals. With regard to their investment activities in other years, one can gather an indication of the preferred capital items acquired by government and private hospitals by looking into their types of installed equipment as of 1991, but noting that some of these may have been actually obtained in 1991. Aside from the number of hospital beds, the DOH-PIDS Hospital Survey also provides data on the availability of a number of medical equipment, of which the major ones are presented below in Table 5: Xray machine, ECG machine, ultrasound machine and magnetic resonance imaging machine (MRI) and CTScan. The first two are required by the DOH-BLR for secondary and tertiary level hospitals, while the other three are optional. The MRI and CTScan are considered as representatives of the so-called prestige technology found in some hospitals in the country in recent years.

From Table 5, the average number of beds and the incidence of the four equipment types consistently rose as the type of care progresses. Among government-owned facilities, while only 17 percent of primary care units installed an Xray machine, the secondary and tertiary care providers showed an incidence rate of 92 and 100 percent, respectively. This pattern across the same types of care is repeated in the private sector: Xrays are found in 39 percent of the primary hospitals only whereas these could be found in 86 and 100 percent of the secondary and tertiary care ilities, respectively.

The more advanced technology in the set - ultrasound, MRI and CT Scan - are seen only in the secondary and tertiary facilities. Again, the appearance rates among private hospitals are higher as compared to public facilities.

Overall, the more interesting pattern gleaned from Table 5 is the seeming preference for bigger bed capacity in the government sector relative to the private sector, especially for facilities in the secondary and tertiary levels. In contrast, relatively more private sector hospitals invested in the four medical equipment. In particular, while the average sampled tertiary hospitals in the private sector had a bed capacity thrice smaller than the average tertiary facility in the government sector, the former had a greater likelihood of providing the more advanced medical device. Neither did majority of the sampled government hospitals in the secondary level possess an ECG machine despite the requirement of the Bureau of Licensing and Regulations. Although compliance in the private sector for the same requirement was not perfect either, the shirkage rate was nonetheless much smaller.

Table 5 : Bed and Equipment Profile of Government and Private Hospitals (Selected Provinces, as of 1991)[1]

Bed Size & Equipment	Government Sector	Private Sector
A. Primary Hospitals		
Average No. of Beds	16.72	17.07
Xray (% with machine)	16.67	39.29
ECG (% with machine)	16.67	39.29
Ultrasound (% with machine)	0.0	0.0
MRI/CT Scan (% with machine)	0.0	0.0
B. Secondary Hospitals		
Average No. of Beds	55.92	32.40
Xray (% with machine)	92.00	86.49
ECG (% with machine)	48.00	78.38
Ultrasound (% with machine)	12.00	24.32
MRI/CT Scan (% with machine)	0.00	0.00
C. Tertiary Hospitals		
Average No. of Beds	441.61	149.63
Xray (% with machine)	100.00	100.00
ECG (% with machine)	88.89	90.00
Ultrasound (% with machine)	72.22	90.00
MRI/CT Scan (% with machine)	11.11	30.00

Source of basic data : DOH-PIDS Hospital Administrators Survey

[1] Sampled hospitals in Bohol, Cagayan, Cebu, NCR, Misamis Oriental, Quirino and Surigao del Norte.

C. Hospital investment by location

A hospital's investment in a single year represent an adjustment of its capital stock at the beginning of the year towards its desired or targetted level. By categorizing hospital investment patterns according to the location of the facility, we implicitly ask whether this has a bearing on the rate of adjustment or on the desired capital stock. From Table 6 below, we note variations in both the propensity of hospitals to invest and the amount of investment by province:

Table 6. Hospital Investment Patterns Across Selected Provinces (1991)

Province	% of Hospitals with Capital Expenditures	Average Capital Expenditures (P million)
Bohol	69.23	1.17
Cagayan	33.33	2.27
Cebu	22.73	6.68
NCR	46.97	2.83
Misamis Or.	80.00	.13
Quirino	33.33	.17
Surigao del Norte	88.89	.24

Source of basic data : DOH-PIDS Hospital Administrators Survey

While facilities in Surigao del Norte as a group showed the highest propensity to invest, they submitted a minuscule amount of investment on average (P.24 million) as compared to facilities in Cebu (P6.68 million). A similar contrasting pattern is obtained among facilities in Misamis Oriental and Bohol. Among Region 2 hospitals, those located in Cagayan display an equally low rate as those in Quirino (33 percent) but, the posted capital expenses averaged in the former at a much higher level (P2.27 million) than in the latter (P.17 million).

As in Table 5, Figures 3-7 below depict the types of capital items acquired as of 1991 by hospitals located in the 7 sampled provinces (see also Appendix Table A.2). It also roughly provides the comparative state of technological diffusion among these

localities to the extent that the range of apparatus represents the most basic (beds) to the most sophisticated (MRI/CT Scan).

The biggest average hospital with a 152 - bed capacity is found in Metro Manila, where hospitals also bear the highest likelihood of providing the service of an X-ray (87 percent), an ECG (80 percent) and an ultra sound (52 percent). One out of ten hospitals in NCR provides either a CT Scan or an MRI. The province with the smallest average bed capacity (31 beds) - Cagayan - is also found to have the least propensity to maintain an X-ray (53 percent) or ECG test (18 percent).

Figure 3

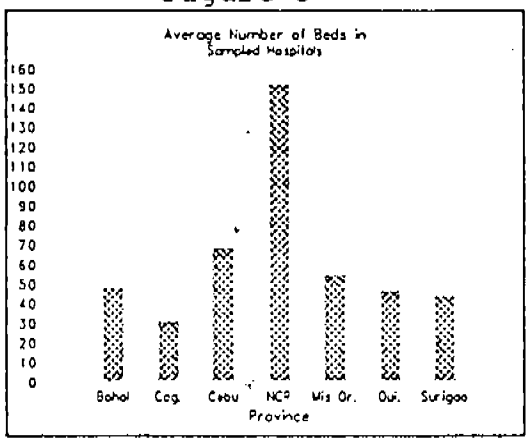


Figure 4

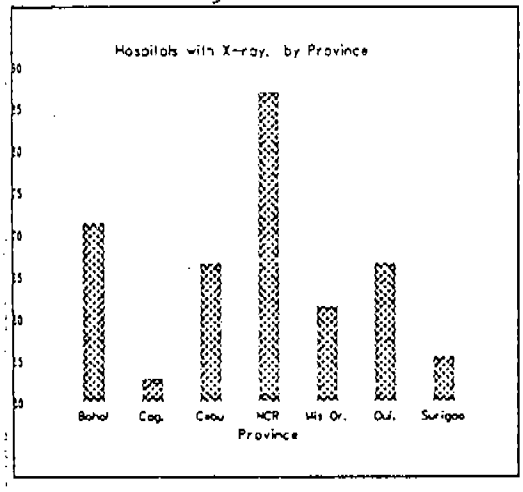


Figure 5

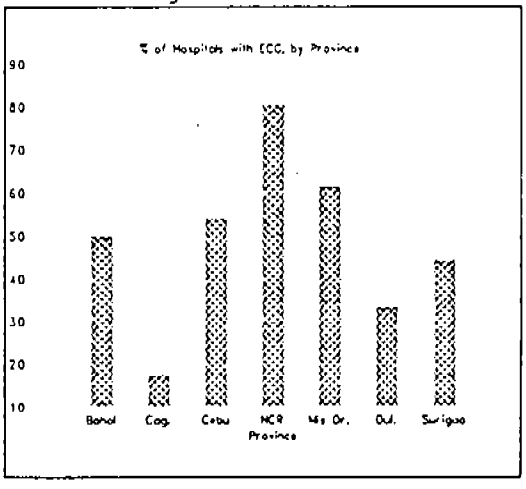


Figure 6

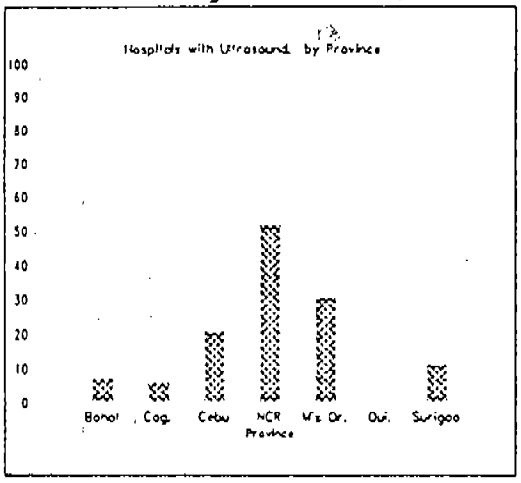
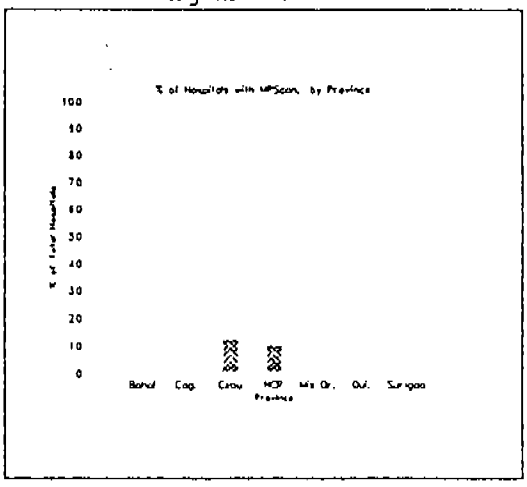


Figure 7



Variations in the characteristics of provinces could impact on investment by affecting either the desired level or mix of capital stock or the rate of adjustment. Among these characteristics are (a) population size; (b) morbidity and mortality rates of the population; and (c) disease patterns. In addition, market variables such as the number and capacity of other providers also vary from one catchment area to another. The implementation of licensure policies also depends on location-specific parameters: the government is supposed to approve the establishment of a new hospital only if the resulting hospital bed-to-population ratio of the catchment area is at least 1:500. (See Appendix Table A.2 for provincial level indicators of health status, population and hospital bed supply).

III. Aspects and Determinants of Hospital Capital Investment

A. <u>The desired level of hospital capital stock and its determinants</u>

Hospitals could be viewed as economic entities that have notions on the size of hospital plant and the stock and mix of equipment that they deem optimal for the delivery of services. Based on the neoclassical theory of the firm's demand for capital as a factor of production, the optimal capital stock will be defined as that which enables a hospital to maximize its net worth or the present value of the stream of net revenues accruing to the hospital over time (Jorgenson, 1963, 1965, 1967). Specifically, this is the capacity where the marginal cost of the extra unit is equal to the discounted future values of its marginal products.

The scanty literature on hospital investment in the U.S. (e.g., Pauly, 1974; Salkever and Bice, 1979; Muller and Worthington, 1970; Wedig, et. al, 1989) offered deviations from the received theory in view primarily of the prevalence of not-for-profit hospitals with varying objectives in the U.S. The first three of the cited studies have assumed that hospitals are de facto under the control of net-income maximizing physicians; the objective of the not-for-profit hospital is thus to maximize the net income of its physicians. With prices of hospital service set so as just to recover average cost, hospital capital stock is optimal when the marginal net physician income productivity of capital (that is the marginal product of capital multiplied by phyician fee) is zero. These models then predict capital stock levels that are larger than the profit or net revenue-maximizing models. This proposition is also derived from other hospital models, e.g. Newhouse's (1970) model where hospitals are posited to have a single utility function with two arguments - quantity (number of days) and quality - and face a breakeven constraint.

One-third of all hospitals in the Philippines are owned by the national and local governments while the rest are privately-owned. Of the latter, only approximately 5 percent are non-profit. Suppose that hospital j's decision-maker has a utility function $U_j = U_j(\pi_j, S)$, where π_j is the profit level and S is a measure of ill health in the community. Private for-profit hospitals may be distinguished from government and non-profit hospitals depending on the importance they place on π_j and S. Government hospitals can be assumed to be more concerned with health status relative to profitsa; private for-profit hospitals, on the other hand, are hypothesized to have a contrary preference.

We assume that utility increases with profit ($\partial U_j/\partial \pi_j > 0$) and decreases with the ill health in the catchment area ($\partial U_j/\partial S < 0$). Hospital j faces an income constraint $\pi_j = P_j N_j(L_j, K_j) - wL_j - cK_j + D_j$ where P_j is the total fee charged by the hospital, N_j the total number of patients which we assume for simplicity to be homogenous, K_j the capital stock with user price c, L_j the labor employed by hospital j at wage rate w and D_j the amount of subsidy and donations. Demand for the service of hospital j is given by $N_j = N_j\ (P_j;\ P_i,\ X)$ which is hypothesized to vary inversely with its own price given the prices of other providers (P_i) and the epidemiologic and demographic of its catchment area (X). Lastly, we have $S = S\ (N_j + N_i)$ where N_i is the given level of users in other facilities in the area. Ill health is assumed to vary inversely with the services of all providers in the catchment area.

The level of capital stock will be chosen which maximizes utility subject to the income constraint, the demand function and the area's ill health function. The marginal condition for optimal capital stock is :

$$P_j\ (\partial N_j/\partial K_j) + N_j\ (\partial P_j/\partial N_j)(\partial N_j/\partial K_j) = c - \sigma_j(\partial S/\partial N_j)(\partial N_j/\partial K_j)$$

where σ_j is equal to $(\partial U_j/\partial S)/(\partial U_j/\partial \pi_j)$ or marginal rate of substitution for hospital j of the area's health status for hospital profits. Capital stock is optimal when the value of the marginal product of capital is equal to the user cost net of the discount attributable to the hospital's contribution to the area's health improvement (or reduction in ill health). It is posited that given the same user cost of capital and marginal revenues faced by government and private facilities, the desired hospital capacity in the government sector would be larger as their valuation of σ_j will be greater, that is, their marginal utility derived from an improved health status of the catchment area is much greater than their utility from profits.

Extending further the above proposition also gives an indication of the type of capital items that would be preferred by government facilities, and this could be gleaned from the valuation of the discount attached to the service derived from a particular capital item such as beds or medical equipment. That is, different equipment would have different marginal products, $\partial N_j/\partial K_{ij}$ where the subscript i denotes the particular equipment at hand. For example, beds would be expected to have higher marginal products (patients) than amenities like airconditioners in the sense a facility must have available beds before it can admit in-patients while it can forego the provision of an airconditioned room. Taking into account the fixity of government hospital prices, and assuming for simplicity that these are equal to zero, the first order condition would now be: $\sigma_j(\partial S/\partial N_j)(\partial N_j/\partial K_{ij}) = c_i$. Taking any two capital items 1 and 2, the condition for a partial equilibrium would be:

$$\frac{\partial N_j/\partial K_{1j}}{\partial N_j/\partial K_{2j}} = \frac{c_1}{c_2}$$

since the first two terms of the left-hand side expressions cancel out. Given two sets of equipment with the same cost per unit, a government facility which aims to allocate its resources efficiently would have quantities of each such that their marginal contribution to total patient care will just be equal to one. This means that if 1 unit of capital item 2 contributes fewer marginal patients to the hospital than 1 unit of capital item 1, then the facility could be expected to have more units of the latter.

Factors affecting demand for hospital care. Insurance coverage and epidemiologic and demographic variables enter the above analysis as they alter the position of the demand curve and, hence, change marginal revenue. Given a linear demand curve, both the moral hazard and adverse selection effects of increased insurance coverage and increased rate of support on the behavior of hospital users redound to shifts in optimal output and, hence, to an

increase in the use of hospital capital. In a catchment area, however, where both public and private hospitals co-exist, the moral hazard effect altering the demand for private facilities may come at the expense of the public facilities to the extent that demand for the services of the latter declines with the income of the user. As insurance support improves, poor patients of public facilities could opt to seek care in private hospitals.

With regard to population growth rates, this factor may not only condition the size of a hospital's desired capacity but also the mix of hospital services and hence hospital technology depending on the underlying causes of the population growth rate increase. Increases in birth rates would augur the need for medical pediatric care while a reduction in the morbidity rate would portend changes in the epidemiological patterns that in turn affect the mix of health needs.

Changes in the age and gender structure also bring about expectations of variations in the medical needs mix: higher female-to-male ratios along with increase of females of reproductive age (15-44) suggest possibilities of expansion in maternal and child care needs. Recent empirical evidence from the hospital utilization model of Solon, et. al. (1994), indicate that although gender does not appear significant in a user's decision to seek hospital care, the probability of hospital admission decreases with age. This implies that population expansion occasioned by a growing infant and child population could push demand for hospital pediatric care, more than it alters the demand for services associated with diseases of the adult population.

Models on hospital investment have so far abstracted from the role of uncertainty in the choice of optimal bed stock and other capital items. As Ellis (1993) points out, in the presence of uncertain demand, a hospital's desire to maintain flexibility could mean that hospitals choose to invest in combination of beds that may be ex ante optimal but are not ex post efficient for any realized value of demand. The key insight from explicitly modelling stochastic demand is that as hospitals approach their maximum capacity, the opportunity cost of filling one more bed increases in the sense that a full hospital may have to turn away a patient. The cost to the hospital is not only in terms of foregone revenues of the excluded patient but also reputation loss or a sense of loss of the "hospital's mission."

Market structure. The availability of other health services in the area also affects the position of the demand curve. Lower prices of alternative providers could cause downward shifts of the demand curve, thus lowering the optimal use of capital. The DOH licensure policies which make new hospital construction and expansion contingent on the given bed capacity of existing facilities also reinforce this potential crowding-out effect.

The experience of U.S. hospitals show, however, the possibility of crowding-in when expansion in insurance coverage spurs non-price competition. Non-price competition may be spurred by efforts to attract patients or physicians and thus stimulate the adoption of new technology (Romeo, Wagner and Lee, 1984) and "reservation quality" or hospital bed reserve margins (Joskow, 1980). As hospital pricing increasingly gets subjected to regulation by say, insurance (i.e., prices are set by the insurance authority) hospitals would have more incentive to expand capacity in those services that enhance their quality relative to their competitors in the area (Pope, 1989). Greater number or larger capacity of competitors in this situation would further lead to bigger hospitals.

Crowding-out may not appear either if the hospital market is segmented. There are varying ways to achieve this : by case mix (hospitals may specialize in the treatment of specific diseases or by service mix (hospitals differentiate the quality of their services). For example, private hospitals specializing in maternity care would not be likely to crowd-out a government hospital specializing in pediatrics. Similarly, the presence of more primary hospitals in the area which serves less complex cases than tertiary hospitals would not be likely to crowd-out the latter in the provision of services required in complicated procedures. Crowding-out among hospitals is less likely the more differentiated they are with respect to case mix.

Abstracting from differences in case and service mixes, Frank and Salkever (1991) also suggest that rivalry between government and private sector providers in giving services that enhance their reputation such as charity care will weaken the crowding-out effect. The government's valuation of the marginal contribution to health improvement of indigent users by private hospitals could be less than their valuation of their own direct contribution. An increase in private hospital capacity would not consequently affect the government's own desired capacity.

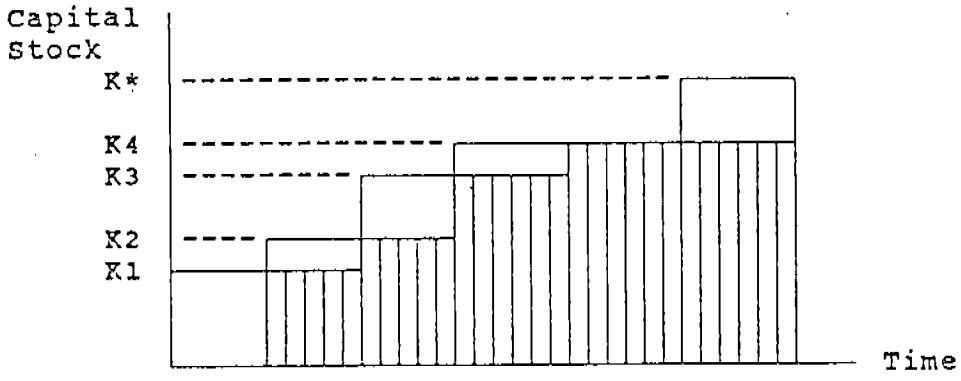
<u>Cost variables</u>. The user cost of capital is given by $c = q(i + d) - g$ where q is the purchase price per unit of capital, t capital sales tax, i the interest rate of funds borrowed to purchase capital, d the rate of depreciation, and g the scrap value per unit. Higher interest and depreciation rates thus tend to discourage a large hospital capacity by pushing the marginal cost of capital. Hence, policies that alter user cost could influence hospital capital stock. Exemptions from payment of duties on imported capital, or government subsidy that effectively reduce the interest rate borne directly by the

hospital in essence lessen purchase price. At present these types of incentives are seemingly enjoyed by government-owned facilities only as presented in Tables 1 and 2. For private for-profit hospitals, although the present income taxation allow for depreciation and interest expense deductions, these do not hypothetically reduce the user cost of capital.

B. The process of investment and its determinants

Because it takes time to build the optimal capacity, a hospital cannot instantly adjust the stock of capital used for patient care. Investment involves the adjustment of existing capital stock to the desired or optimal level over the course of time. Denoting the desired capital stock as K^*_j and the level of existing capital stock at the end of a period as K_{ij}, this adjustment over time is illustrated below:

Figure 3. Adjustment of Hospital Capital Stock



The initial capital build-up is given by K_{1j}; to reach the desired level, the hospital would have to invest in period i an amount shown above by the unshaded portion and is equal to $\alpha_{ij}(K^*_j - K_{(i-1)j})$ where α_{ij} is the rate of adjustment.

Gross investment in period i of hospital j (I_{ij}) is comprised of new construction or acquisition to expand capacity, and replacement investment which is usually assumed to be proportional to the beginning capital stock $K_{(i-1)j}$. Given these, we have :

$$I_{ij} = \alpha_{ij}(K^*_j - K_{(i-1)j}) + \beta_j K_{(i-1)j}$$
$$= \alpha_{ij}K^*_j + (\beta - \alpha_{ij}) K_{(i-1)j}$$

The amount of hospital investment in period i is thus dependent on (a) the determinants of desired capital stock as discussed earlier; (b) the rate of adjustment; and (c) existing capacity as of last period. For a given rate of adjustment and current capacity level, the higher the level of investment in a period, the larger the desired capital stock. Likewise, for given levels of K_{ij} and $K_{(i-1)j}$, hospital investment will be found greater with a faster rate of adjustment. Lastly, with a rate of depreciation larger than the rate of adjustment, the gross rate of investment will move positively with the size of existing capital stock.

Availability of funds. The flexible accelerator model described above does not sufficiently address the timing of investment. But, as presented in Figure 1, not all hospitals had investment in 1991, i.e., the rate of adjustment in that year was equal to zero for some hospitals although it may be presumed that they did incur capital expenses in some prior years. Because these expenses are undertaken for the long-run and require several years to complete, there is some flexibility in the dates on which the actual investment may take place.

In empirical models of U.S. hospital investment (Feldstein, 1981; Salkever and Bice, 1979), the rate of adjustment is suggested to depend on availability of funds such as grants or loans with low interest rates that are made available for a limited time period and the extent of regulatory limits on expansion. (If grants are permanently available, the desired capital stock and not the rate of adjustment will change).

Table 2 shows that most private hospitals financed their capital spending from internal savings. Hence, we may expect that for private hospitals who have several potentially profitable investments but do not enter the debt or equity markets to obtain capital, variations in the flow of internally-generated funds could also cause cross-sectional differences in investment rate. As for government hospitals, we would instead expect that availability of DOH budgetary appropriations influences their investment pattern.

Regulation. The main benchmark used by the Bureau of Licensing and Regulations in regulating hospital capacity is the total number of beds and the so-called technical requirements to implement "minimum" standards. The authorized number of beds of hospitals should be such that total hospital bed-to-population ratio in the catchment area will not go below 1:500. The list of technical requirements consists of (a) the size of technical and non-technical staff on a per-bed basis; (b) minimum set of medical and non-medical device; and (c) physical set-up of the hospital building. Such regulations if strictly imposed on a permanent basis are posited to affect the desired capacity of the hospital; however, if implemented in an arbitrary manner from year to year, it may likewise affect the rate of adjustment. The rate of

adjustment for bed expansion, for example, could be higher if for certain reasons the bureaucracy opts to relax the bed requirement in a certain year.

IV. Decision to Invest and Amount of Capital Spending : Estimation Variables, Data and Results :

A. Estimation variables and data

Based on the foregoing discussion, a behavioral model of hospital investment or capital expenditures is postulated:

$$I_j = \alpha_{kj} Z_{kj} + e_j$$

where j = hospital
Zk = kth independent variable
k = 0 constant
= 1 in-patient fee in previous year
= 2 out-patient fee in previous year
= 3 average wage in previous year
= 4 total bed capacity of other government hospitals in the province
= 5 total bed capacity of other private hospitals in the province
= 6 assets as of the previous year
= 7 number of years hospital is in operation
= 8 proportion of patients who underwent surgery
= 9 average mark-up from Medicare patients
= 10 number of private insurance scheme accreditation/affiliation
= 11 growth rate of provincial population
= 12 provincial infant mortality rate
= 13 ownership

Prices of hospital in-patient and out-patient services are determinants of the desired capital stock as they affect the level of services produced by the hospital but, they also affect the rate of adjustment as they directly impact on the level of internally-generated funds needed to support the demand for investment. Either way, we expect prices to correlate positively with investment. Assuming that future prices are positively related to past prices, we used as regressors the prior year's fees for in-patient and out-patient services as proximate measures of their expected price. Using the prior year's price also avoids the bias arising from the simultaneity of price and investment decisions (e.g., the purchase of a new machine in 1991 could lead to higher hospital price in that same year). Since the PIDS-DOH hospital data set do not include 1990 prices, these data were generated by deflating the 1991 prices of the surveyed hospitals by the regional price deflators for medical services obtained from the National Statistics Office (NSO). Table 7 provides a description of average prices and other variables used in the regressions. In-patient fee

Table 7 : Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
With investment in 1991	0.57	0.50	0.00	1.00
Capital expenditures in 1991 (in millions)	2.60	6.46	0.00012	35.44
Log of previous variable	12.95	1.97	9.39	17.38
Previous year's fee per discharge	1226.60	1934.98	6.89	8271.64
Log of previous variable	6.03	1.54	1.94	9.02
Previous year's fee per out-patient contact	105.30	207.30	0.28	1554.90
Log of previous variable	3.50	1.74	-1.26	7.35
Average wage per month	3251.13	1260.36	801.74	10759.61
Bed capacity of other gov't hospitals in prov.	2698.06	3471.39	60.00	10620.00
Bed capacity of other private hospitals in prov	907.47	849.59	40.00	3158.00
Number of years hospital is in operation	23.00	19.16	1.00	90.00
Provincial infant mortality rate	27.36	4.01	20.00	32.00
Unemployment rate in province	9.27	3.70	4.60	14.10
Mark-up from Medicare patients (%)	4.78	12.67	-0.86	93.75
Ratio (in %) of Surgery Dep't. patients to total patients	8.52	7.53	0.00	26.26

Table 7 (Con't.) : Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
Assets as of end 1990	3.68+07	1.63+08	70039.99	1.39+09
Average annual growth rate of prov'l population, 1980-90	2.53	0.71	1.61	3.58
Growth rate of per capita regional gross value added of private medical services, average for 1986-89	5.95	5.13	-2.12	10.72
Government-owned	0.46	0.50	0.00	1.00
Number of private insurance accreditations/affiliations	0.97	2.03	0.00	11.00
Total hospital beds	101.39	214.82	5.00	2000.00
Number of doctors practicing in hospital	22.43	41.55	0.00	259.00
Bed capacity of other gov't hospitals in municipality	1261.14	1921.80	0.00	5970.00
Bed capacity of other private hospitals in municipality	745.10	1083.99	0.00	3158.00
Located in Manila	0.48	0.50	0.00	1.00
Located in Bohol	0.09	0.29	0.00	1.00
Located in Cagayan	0.11	0.31	0.00	1.00
Located in Cebu	0.15	0.36	0.00	1.00
Located in Misamis Oriental	0.08	0.28	0.00	1.00
Located in Quirino	0.02	0.14	0.00	1.00
Located in Surigao	0.06	0.23	0.00	1.00
With X-ray	0.75	0.43	0.00	1.00
With ECG	0.63	0.49	0.00	1.00
With Ultrasound	0.34	0.47	0.00	1.00
With MRI or CT-Scan	0.07	0.26	0.00	1.00

per discharge averaged at P1226.59 while out-patient fee per contact averaged at P105.30.

Average wage of hospital personnel is a proximate measure of the prices of variable inputs used in the hospital. If variable inputs and capital are substitutes, we should obtain a positive coefficient for average wage. To the extent, however, that certain medical devices have to be complemented with high-salaried specialized personnel (e.g., radiology and laboratory personnel) thus pushing the mean wage, a negative sign will be obtained. To get the previous year's wage level, the 1991 average wage of sampled hospital was also deflated by the regional price deflator for medical service. The sampled hospitals in this study submitted average wages ranging from a low P801.00 per month to P10,759.61 per month.

Market structure shifts the position of the demand curve for hospital services and consequently alters the value of the marginal revenue product of capital. Although using the total *bed capacity of other facilities* would have sufficed to represent market structure, segregating these into *public and private* would give better information. It is hypothesized that hospitals posture differently to the presence of government and private hospitals for a number of reasons such as market segmentation. Government hospitals generally have lower-priced services associated with low quality (i.e., low quality manifested by longer queues or waiting time or lack of medicine) to which private hospitals could react by offering better quality and higher-priced services, or by directly providing services that are not readily available in public facilities. Segmenting the market along this line allows public and private hospitals to co-exist without crowding-out each other from the market.

On the other hand, if BLR policies effectively limit the number of beds in an area, crowding-out could occur with respect to bed expansion. That is, the larger the combined bed capacities of all other facilities, we expect a sample in that area to have lower investment in beds. Total capital expenditures may be unaffected, however, if hospitals choose to substitute non-bed hospital apparatus for beds; expenditures may even be larger to the extent that their relative prices are higher. Total bed capacity of other providers in the regression refers to authorized bed capacity excluding actual total beds of the sampled hospital. The first data were culled from the 1991 Masterlist of BLR-licensed hospitals while the sampled hospitals' beds were lifted from the PIDS-DOH Survey. As shown in Table 7, there were 2698 other government beds and 907 other private hospital beds found within the provincial boundary of our average sample hospital.

In the absence of a single measure to capture aggregate physical capital stock, *assets at the beginning of 1991* appear as a proxy measure of existing capacity prior to investment. (A major

shortcoming in using this variable, however, is the diversity in the assessment of assets among hospitals plus the lumping of financial assets with fixed assets). To come up with this data, the reported total assets as of end 1991 was taken from the PIDS-DOH Survey. Total capital expenses spent during the year was subtracted from the 1991 assets to generate total assets at the beginning of the year. The average hospital in our sample had total assets valued at P36.8 million as of end 1990 (see Table 7).

Since the value of depreciated capital does not only depend on hospital capacity but also on the age of this capacity, the latter has to be included as one of the regressors. We expect older hospitals to accumulate equipment of earlier vintage, thus a proximate data was simply obtained by getting the *number of years the hospital has been in operation as of 1991*. The most recently established hospital in our sample was one year-old while the oldest was 90 years old as of 1991.

The eighth regressor, *ratio of surgery patients to total patient load*, represents the case mix or type of medical service of the facility. Furthermore, since patients who underwent surgery are generally those who require relatively more diagnostic tests and equipment-intensive medical protocols, their incidence also roughly captures the technology prevailing in the hospital. The higher the incidence of surgery patients in a facility, the more likely that its average patient will be using a diagnostic or therapeutic equipment. Hence, we expect this to yield a positive impact on hospital spending for capital. New investment will also be spurred to the extent that replacements of old machinery are new models or of more recent technology. From Table 7, we note that 8.52 percent of all patients in the average sampled hospital underwent surgery.

There are two insurance variables appearing on the right hand side : (a) the *rate of hospital mark-up on Medicare patients;* and (b) the number of *private insurance scheme affiliations/ accreditation of the hospital*[3]. Both variables are presumed to improve the hospital's ability to generate funds through its internal operation by pushing marginal revenue. In addition, admitting patients insured with private schemes lessens the risk of the hospital to carry bad debts due to abscondment of patients or non-payment, thus improving their profitability.

The mark-up rate is derived by subtracting the actual charge of the hospital per in-patient from the average Medicare support value in the region, and expressing this as a percentage of the

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[3] We also attempted to use Medicare coverage per province as a regressor. However, data on the provincial membership profile (pricipal members plus dependents) as of 1990 gave unusually high ratios; for example, Medicare membership in Metro Manila would exceed its total population.

latter. Actual charges were lifted from the PIDS-DOH Hospital Survey. The Medicare support values were taken from the PMCC survey results reported in Solon, et.al (1991). The number of private financing scheme affiliations was similarly taken from the PIDS-DOH Survey. From Table 7, we note that the average hospital in our sample had a 4.78 percent mark-up from Medicare patients and was affiliated or accredited with with one private financing scheme.

A proximate measure of changes in catchment area size which could also shift the demand hospital care is the *population growth rate*. In Salkever and Bice's study on U.S. hospital investment (1991), changes in hospital beds from 1969 to 1972 were found to correlate positively with changes in population from 1964 to 1968 but not with the population change in 1969-1972. This suggests that investment decisions were shaped by expectations based on historical rates rather than actual contemporaneous growth rates. Accordingly, also included as an independent variable is the average population growth rate of the province from 1980-1990 based on the 1990 Census on Population. In addition, since health status varies across population groups, the 1990 provincial IMR taken from the 1990 National Health Statistics is also included as a regressor. Table 7 reports the average annual population growth rate in the sampled provinces at 2.52 percent. Infant mortality rate in the average sampled province stood at 27.36 per 1,000 livebirths.

Aside from Medicare, the other policy variables that are of interest to us as they affect the cost of capital and the rate of adjustment are direct government subsidy and tax exemptions. As shown in Tables 2 and 3, availment of these assistance varied systematically depending on the ownership of the facility : virtually all government facilities with spending for capital received direct funding and tax assistance while none among the private facilities secured the same. A dummy for ownership would thus suffice to capture the effects of these policies. Government-owned facilities constituted 46 percent of our samples. It is also important to note that our basic premise regarding the behavior of government hospitals as discussed in Section II predicts that given the same user cost which privately-owned facilities also face, the former would have larger capital stock relative to the latter due to the discount on cost associated with the utility that government derives from improving the health status of the catchment area.

The estimation procedure has to take into account the fact that not all sampled hospitals had incurred capital expenses in 1991. If the regressions were done only on the samples having positive investment, our estimated coefficients will be biased and inconsistent. To address this sample selection problem, Heckman's two-step estimation procedure is employed. The first stage involves the probit estimation of the selection variables:

$$s_j = \beta_{nj} Z_{nj} + v_j,$$
$$s_j = 1 \text{ if } I_j > 0$$
$$s_j = 0 \text{ if } I_j = 0$$

where the n explanatory variables consist of the k determinants of the investments equation described above plus two identifiers, the average growth rate of the per capita regional gross value added from 1986 to 1990, and the unemployment rate in the province. These were taken from the NSCB.

The first stage yields the inverse mills ratio that enters the second stage, OLS equation of capital expenditures presented above. The procedure gives unbiased and consistent estimators, although they are inefficent (Green, 1990). In addition, the first stage also informs us of the factors that influenced the hospital's decision to invest or not in the specific period under study (1991).

B. Regression results

1. Probit estimation of the decision to invest in 1991

Presented in Table 8 are the results of the two-step Heckman's procedure. The coefficient of the inverse mills ratio in the capital expenditures equation is insignificant suggesting that a straighforward OLS regression of the equation would essentially yield the same result. Nevertheless, the probit model is important by itself as it points to us three significant determinants of a hospital's decision to invest in the period under study. These are: (a) capacity of existing beds of private facilities in the province; (b) the case mix of the hospital, specifically the ratio of patients who were attended to with surgical procedure; and (c) the number of private financing schemes to which the hospital is affiliated. Specifically, the marginal probabilities due to these factors are given below in Table 9:

Table 8 : Parameter Estimates Using Heckman's Procedure

Independent Variables	Decision to Invest in 1991		Log of Capital Expenditures in 1991	
	Coefficient	T-stat	Coefficient	T-stat
Constant	3.94	1.20	6.68	2.89*
Previous year's IP fee			.39E-03	2.09*
Log of previous year's IP fee	-.03	-.14		
Previous year's OP fee			.89E-03	.45
Log of previous year's OP fee	.24	1.54		
Average wage	-.76E-05	-.04	-.11E-03	-.58
Bed capacity of other gov't hospitals in province	-.37E-04	-.49	-.63	-.72
Bed capacity of other private hospitals in province	-.90E-03	-2.85*	-.40E-04	-.08
Number of years hospital is in operation	.11E-02	.09	.35E-02	.26
Prov'l infant mortality rate * 100	.01E-02	-1.81	.017	2.75*
Prov'l unemployment rate	.10	.88		
Mark-up fr. Medicare patients(%)	.02	.96	.04	2.12*
Ratio of Surgery Dep't IP to total IP (%)	.07	2.38*	.08	2.05*
Assets as of 1990	.19-08	1.10	-.26E-08	-2.01*
Prov'l. population growth rate	-.74	-1.64	-.41	.69E-02
Growth rate of per capita value added of private medical services	.08	.91		
Government-owned	-.08	-.14	1.42	2.30*
Private insurance accreditations	.48	1.96*	.21	1.61
Covariance of error terms with model 1			-.29	-.37
Number of observations	94		52	
Percent correct predictions	0.82			
Adjusted R-squared			.41	
F-statistic			3.56	

The probability of a hospital to spend for capital expenditures increases by 11.67 percent for every accreditation or affiliation with a private insurance scheme. As posited earlier, accreditation enhances a hospital's ability to generate profits by altering the demand for its services. Note that since all of our sampled hospitals were also accredited with Medicare, the Medicare variable that entered our regression was the mark-up rate which differed across our samples. However, this did not emerge as a significant determinant in the probit model (see Table 8).

As expected, hospitals with greater concentration of patients requiring surgery have greater propensities to spend for fixed assets. For every 1 percent share of the surgery unit to the total in-patient load, the hospital increases its likelihood to invest by 1.63 percent.

The results also show that market structure also impinges on decisions to invest. Yet, this effect appears only when the private hospital sector in the province becomes more pervasive. For every 100 private hospital beds in the province, the likelihood of a hospital to expand and/or spend for maintenance or replacement investment drops by 2 percent. However, this crowding-out effect is absent if the other providers are government-owned. As pointed out earlier, this scenario is plausible when potential demand for certain services exists but is not made available by existing public providers so that entry or expansion by a private provider is possible without encroaching on the market share of public facilities.

Contrary to expectations, higher fees have no impact on the probability to invest. Also, the instrument variables for the size and age of the hospital capital stock which are supposed to positively influence decision to spend for replacement of depreciated stock do not show up significantly. Moreover, hospitals in the private sector are not more likely to spend for fixed assets as compared to government-owned facilities. Finally, catchment area characteristics have no impact at all.

2. Level of capital expenditures

Table 8 gives the factors that determine the pattern of spending for equipment and other physical assets across hospitals as follows: (a) in-patient fee; (b) infant mortality rate in the province; (c) case mix; (d) mark-up from Medicare; (e) assets at the beginning of the year; and (f) ownership.

As shown, capital expenditures of hospitals with higher in-patient fees are greater relative to that of hospitals with lower fees. However, variations in out-patient service fees have no bearing on the variations in capital expenditures. These results would not be unexpected when high in-patient fees generate greater

increments to total revenues than high out-patient fees. We may note the larger contribution of in-patient departments to the hospital coffers which is estimated at 64.48 percent (1991 PIDS-DOH Hospital Administrators Survey). In addition, it may be surmised that the marginal product of capital from out-patient contacts is relatively low compared to in-patient services. In other words, out-patient services in most cases probably consist primarily of professional consultation and less of machine-based diagnostic tests (e.g. X-ray, CT Scan) and are therefore labor-intensive rather than capital-intensive.

In any case, capital expenditures are virtually inelastic with respect to in-patient fees: stated in another way, the result in Table 7 indicates that a percent change in the prior year's average in-patient fee redounds to only .57 percent increase in hospital capital spending[4].

Variations in the provincial infant mortality rates also affect hospital capital spending. Higher IMRs in the past year can be generally associated with higher morbidity rates in the current and future years and thus lead to larger expectations of unmet needs for hospitalization. The consequent shifts in expected demand have a positive correlation with the amount of capital expansion and maintenance spending. From Table 7, it is suggested that an increase in the prior year's provincial IMR by 1 percent induces an increase in capital expenditures of the average hospital by .004 percent.

Note that another demand parameter, population growth rate, is not found to be a significant determinant. This result has perhaps to do with the factors underlying the population growth rates. If the high rates are occasioned by low mortality rates suggesting an overall improvement in health status, the consequent dampening effect on demand for hospital care would counter the expansionary tendencies due to high birth rates.

As hypothesized, hospitals with bigger admissions for surgery also came up with larger spending for capital. Surgery patients are surmised to have more intensive uses of medical equipment relative to non-surgically treated patients. From Table 8, we can also derive the result that a 1 percent increase in this case mix ratio obtains a .008 percent raise in capital spending.

Higher mark-up rates from Medicare patients are found to correlate positively and significantly with larger spending for capital : this increases by .13 percent increase for every 1 percent increase in the mark-up. However, affiliations or

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[4] The elasticities presented in this section are derived by multiplying the coefficients of the particular regressors shown in Table 8 by their mean values taken from Table 7.

accreditations with private insurance schemes are seemingly not important. The latter finding probably stems from the still small contribution of private financing-enrolled patients to hospital revenues. From the PIDS-DOH Hospital Users Survey, it is noted that only 3 percent of patients treated in private hospitals were supported by at least one private insurance scheme whereas Medicare supported 34 percent. In the government sector, a measly 1 percent of all patients admitted were covered by private insurance while 26 percent were subsidized by Medicare. In the light of the finding in the first stage probit model, the second finding here then hints that affiliation with private insurance schemes is probably important in setting the desired or optimal hospital capital stock in the long-run. However, this has not yet proved vital in shaping the average hospital's adjustment towards the desired stock due to the currently low participation rate of hospital users in these schemes.

Part of gross capital expenditures is attributable to the hospital's efforts to replace depreciated capital. However, the regression results do not support the contention that variation in the age of hospitals would partly explain the observed variation in capital expenses. We would have expected relatively old facilities to spend more for replacement capital.

Moreover, higher assets prior to investment also inhibit capital spending : a 1 percent change in this variable yields a reduction in the average hospital's capital expenses by .14 percent. If assets are indeed a good proximate measure of hospital capital stock, the negative coefficient basically indicates that the rate at which the average hospital expands its current capacity towards its optimal capacity is larger than the rate at which current capacity is reckoned to depreciate.

Finally, ownership of the facility by the government increases the average facility's capital spending by P546,975.69. As previously discussed, this could be traced, among other factors, to (a) monopoly of government's hospital access to direct government subsidy which allows them acquire more capital items ; (b) better access to tax exemptions which lessens the cost of acquisition; and (c) the higher incremental utility that government derives from improving the health status of the catchment area at the expense of hospital profits.

V. Investment in Beds and Four Hospital Equipment

A. <u>Regression model specification and data</u>

Due to lack of data on the purchase price and cost of financing of the set of equipment under consideration, a fully specified investment (demand) model that follows from the analytical framework discussed in section III cannot be attempted.

fence, the objective of this section is simply to ferret out the important characteristics of hospitals and the provincial market which had bearing on their acquisition of hospital beds and four medical equipment (X-ray, ECG, ultrasound and CT Scan/MRI machines) in 1991 and/or prior years. To pursue this, two types of multivariate analysis were undertaken: (1) an ordinary least squares (OLS) regression of the actual bed capacity of hospitals; and (b) probit estimation of the decision to install the four sample machines. It should be mentioned at the outset that omission of the price and financing variables will give us biased estimators to the extent that hospital and market characteristics are correlated.

Hospital bed size. The number of beds in a hospital is posited to depend on (a) ownership; (b) the year it was established or age of the hospital; (c) bed capacity of government hospitals in the municipality; (d) bed capacity of private hospitals in the municipality; and (e) location. Note that the bed size of the average sampled hospital is 101, with the smallest having only five beds and the largest 2,000 beds.

For reasons presented earlier, we would expect government hospitals to choose larger bed capacities compared to privately-owned facilities.

The year that a specific provider entered the market will have an effect on bed size to the extent that not all providers enter at the same time. An earlier entrant could take advantage of the absence of a competitor to build bigger capacities since this also presents an opportunity to develop a larger market share. Moreover, in areas where the bed supply-to-population ratios of the Department of Health - Bureau of Licensing and Regulations are binding, later entrants in the market are disadvantaged since they have to contend with the bed capacity of facilities put up in earlier years. However, if this DOH policy is not strictly enforced and crowding-out of late entrants due to positioning of earlier entrants are averted by differentiating the services they offer, then the date of entry would not matter.

For similar reasons stated in our discussion on the hypothesized determinants of capital expenditures, bed capacities of other providers in the catchment area may or may not impede the choice of hospital bed capacity. Other providers were reckoned at the municipal level instead of the provincial level because of the dummy variable for province that is also included as a separate regressor as will be discussed below. As shown in Table 7, the number of "competing beds" in the government sector at the municipal level faced by the average sample hospital in 1991 stood at 1,261; those owned by the private sector reached 745.

The effect of location on bed capacity reflects a number of

determinants that affect the choice of optimal bed capacity or the rate of adjustment through their impact on the demand curve or the marginal revenue of the hospital. These determinants include the health status of the catchment area (proxied by infant mortality rate in our capital expenditures equation), population and insurance coverage of the population. While we were able to enter these variables separately in our capital expenditures regression, this cannot be similarly done here because of the lack of information on the date (year) when the set of beds (and the specific equipment in the other regressions) were purchased. The correct specification of the demand for beds equation would have the expected changes in health status and of the other variables as of the time the beds or equipment were acquired and not after these were acquired. In any case, our assumption for using location to represent these is that these are location specific. That is, we assume that hospitals in Metro Manila, for example, consider only the demographic and epidemiologic changes in this area and ignore other provinces when reckoning the possible shifts in their demand curve due to these parameters.

Acquisition of equipment. Because of the lack of data specific to the acquired set of equipment under study (e.g., date when machine was acquired, cost), the probit model for this proceeds from the assumption that the decision to have a medical machine installed in the facility depends on the characteristics of the hospital and market only, including location. As stated earlier, this will have serious implications in interpreting the results because of the possibility of having biased estimators arising from the omission of the aforementioned variables.

In addition to the explanatory variables that were listed as regressors in the OLS equation for bed capacity, we also include the type of hospital care provided by the investing hospital. Firstly, in order for hospitals to be licensed as providers of primary or secondary or tertiary medical care, they have to comply with the minimum standards of the DOH-BLR regarding their set of equipment. For example, in Section II it was mentioned that secondary and tertiary hospitals should have a radiologic equipment (X-ray) and an ECG machine.

Secondly, in order to deliver their pre-listed medical services for which they were licensed, a set of physician skills must also be made available by the hospital and which should be complemented by the presence of diagnostic machine. While primary and secondary hospitals are supposed to provide general medicine, pediatric, obstetrics and gynelogy and surgery only, tertiary hospitals should, in addition, have available physician and other manpower skills necessary to produce more speciliazed services such as cardiology, gastroenterology, hematology, neurology, orthopedic and traumatic surgery (See Appendix B). Consequently, the likelihood for tertiary care hospitals to demand for the types of

equipment that are inputs to these specialized services is expected to be higher.

Because type of care perfectly predicts the presence of some of our sampled equipment (e.g. all tertiary hospitals have X-ray) thus not allowing the convergence of our probit estimation, number of beds was instead used as an instrument variable for type of care. Data from the PIDS-DOH Hospital Survey data indicate that bed size varied by type of care as follows: primary hospitals are generally 1.5 and 14 times smaller than the average secondary and tertiary hospital, respectively.

Another hospital characteristic that would also influence decisions to invest in equipment would be their target or desired medical technology or protocols. Because this is most likely determined by physicians practicing in the hospital, the number of doctors is thus included as a regressor. The hypothesis is that having more physicians increases the likelihood that information on, and pressures to adopt technological advances would be presented to the hospital.

B. Discussion of results

Bed capacity. Table 10 gives the results of the OLS estimation for bed size and the probit estimation for the presence of X-ray, ECG, machine and MRI/CT SCan. As predicted, government ownership of a facility introduces a change in bed capacity in the upward direction. Holding all other determinants constant, government ownership would account for 148 beds more in a facility as compared to private ownership. This incremental effect was earlier posited to be jointly contributed by (a) monopoly of government's hospital access to direct government subsidy; (b) better access to tax exemptions in so far as beds were imported; and (c) the inherent desire for larger bed capacity on account of the utility that government derives from reducing illness incidence in the catchment area at the expense of hospital profits (cf. Section III).

The cumulative bed capacity of other private providers in the area is suggested to have a "crowding-in" effect, although this is quite small : 6 beds for every 100 other private beds in the area. On the other hand, the existing capacity of government hospitals is not shown to be correlated with bed size.

An earlier entrant in the hospital market does not have a larger bed capacity since the obtained coefficient of hospital age is insignificant. Corollarily, in choosing their bed capacity, newer hospitals are not disadavantaged or constrained by the bed size of hospitals already existing in the municipality at the time of their establishment.

Table 10
Regression Results for Bed Size and
Presence of X-ray, ECG, Ultrasound and MRI/CT Scan

Independent Variables	Dependent Variables and Estimation Procedure				
	Number of Beds (OLS)	Presence of X-ray (Probit)	Presence of ECG (Probit)	Presence of Ultrasound (Probit)	Presence of MRI or CT Scan (Probit)
Constant	-39.79 (-1.36)	-0.96 (-2.76)*	0.05 (-0.22)	-1.05 (-4.17)*	-1.62 (-3.80)*
No. of beds		0.04 (3.26)*	1.01E-03 (0.85)	6.41E-05 (0.09)	1.72E-03 (2.25)*
No. of doctors		0.07 (1.39)	0.02 (2.14)*	0.06 (4.29)*	0.01 (2.70)*
No. of years hospital is in operation	0.03 (0.48)	-5.80E-04 (-0.48)	8.27E-0 (0.83)	2.82E-03 (0.26)	4.99E-03 (-0.41)
Government-owned	148.80 (4.34)*	-0.24 (-0.75)	-0.51 (-1.94)	-1.11 (-2.28)*	-1.55 (-2.37)*
No. of other gov't beds in mun.	-0.01 (-0.93)	2.38E-04 (1.09)	0.17E-04 (0.14)	-3.36E-04 (-2.21)*	-1.50E-04 (-0.81)
No. of other private beds in mun.	0.06 (2.48)*	-6.64E-04 (-1.99)*	-2.5E-04 (-1.21)	4.42E-04 (1.80)	2.04E-04 (0.6288)
Located in Manila	104.89 (2.49)*	0.86 (2.08)*	0.82 (2.61)*	0.74 (2.03)*	-0.10 (-0.20)
Number of Observations	155	155	155	155	155
Adjusted R-squared	0.17				
F-stat	7.50				
% Correct Predictions		.8681	.7355	.8258	.9226

* Significant at 5 % level of significance

Finally, hospitals located in Metro Manila are generally larger than those found in the other sampled provinces. This is as expected in view of the province's population size which is the largest among the sampled provinces (see Appendix Table A.2). Also, the NCR is considered as the national referreal center, meaning that the catchment areas of hospitals located here might actually extend beyond the geopolitical NCR boundaries. Moreover, we also note from the PIDS-DOH Household Survey (1993) that as of 1992, the average household expenditure, which also includes consumption of health care, was highest in NCR.

X-ray machine. Hospitals with larger bed capacities are likely to have invested in an X-ray machine : the probability of this scenario increases by .75 percent for every 1 hospital bed (see also Table 11). Note, however, that having more doctors (after controlling for bed size) does not seemingly affect the demand for this machine by a hospital.

However, the likelihood of having invested in an X-ray diminishes as the size of the private hospital sector in the municipality where the hospital is located expands. The marginal probability arising from this "crowding-out" effect is, however, small : this amounts to 1.3 percent for every 100 beds that are available in other privately-owned facilities. Presumably, the likelihood of finding another X-ray in the municipality is greater the more hospital beds there are, thus discouraging acquisition.

Unlike what came out in the bed size equation, government ownership does not appear to matter with regard to X-ray acquisition. The year when the hospital was established is similarly irrelevant. That is, old hospitals have the same propensity as newly establised facilities to acquire this device. This probably has to do with the nature of the machine as a basic diagnostic device.

Lastly, hospitals located in the National Capital Region are shown in the probit model to have higher propensities for having an X-ray. Specifically, there is a 17 percent improvement in finding this device in NCR as compared to the other sampled provinces.

ECG machine. Whereas the number of beds came out to be the more important characteristic in identifying a hospital's likelihood of having invested in an X-ray machine, this is replaced by the number of doctors in the acquisition of an ECG machine. The probability of a hospital acquiring an ECG machine increases by .46 percent for every doctor that practices in the hospital, including training resident physicians and cosulting specialists. With more doctors affiliated with the hospital, the number of patients admitted or referred to the hospital is expected to be higher, thus improving demand for this machine. On the other hand, larger bed capacities per se do not correlate significantly with investment in an ECG.

The only other regressor shown to predict the acquisition of an ECG is hospital location. Hospitals in Metro Manila are 25 percent more likely to have this machine compared to the other sampled provinces.

Ultrasound. The role of doctors is similarly important in a hospital's decision to obtain an ultrasound machine. A facility is 1 percent more certain of installing the machine for every doctor that practices therein.

If the facility is owned, however, by the government (national or local), the tendency to invest declines by 19 percent. In the light of the proposition regarding government investment behavior in Section III, this outcome is expected if government decision-makers (that is, the DOH central officers who can disapprove of the chief of hospital's recommendation) systematically perceive that the marginal contribution of an ultrasound machine in reducing illness incidence in the catchment area would be less than the contribution of other alternative investment choices such as beds.

Facilities found in areas with more government-owned hospital beds are less likely to acquire an ultrasound machine, although this effect is very small : this amounts to a .006 percent loss in the probability for every government bed. The analytical framework in Section III would not be able to explain why this would occur. However, it may be surmised that the presence of government hospitals in the area means that the provider has to contend with low-priced alternatives of their own services. The pressure then to compete in terms of the price of the service is greater; low prices in turn discourages provision of costly inputs such as the ultrasound machine.

Facilities in the NCR are 13 percent more likely to have acquired an ultrasound as compared to facilities in other provinces.

CT Scan and/or MRI. From Tables 9 and 10, variation in the number of beds and doctors in a facility both correlate positively with the probability of a facility's installation of either of these two "prestige" machine. The marginal probability due to an expansion in the actual number of beds (by one unit) is .01 percent while the marginal probability due to the practice of one more doctor in the hospital is .11 percent.

Variations in bed supply of other hospitals in the government and private sectors in the same municipality apparently do not matter in explaining the availability of these machines in a particular facility. That is, potential competition in terms of beds do not hamper the facility's decision to invest in this case. As forwarded earlier, this would be consistent with the scenario where hospitals coexisting in the same area are able to

differentiate their services so that crowding-out is avoided.

Finally, facilities owned by the government are 14.22 percent less likely to have MRI or CT Scan. Also, those located outside the NCR have the same likelihood to provide these services. From Figure 7, however, we note that only NCR and Cebu have hospitals which actually have these equipment. NCR and Cebu have the highest average household expenditures among the sample provinces in addition to having the highest population, hence expected demand in these areas would be relatively high.

VI. Summary and Implications For Policy

This baseline study attempted to explain the variation in investment behavior of hospitals in terms of their likelihood to incur capital spending, the amount of capital expenditures, and to a very limited extent, their bed capacity and the types of medical equipment they had chosen to invest in. In particular, we were interested in the effects of (a) insurance (Medicare and private); (b) ownership, to the extent that public and private hospitals operate under different incentive schemes; (c) location, to the extent that demographic and epidemiologic and socio-economic characteristics vary from province to province; and (d) market variables such as the bed supply of other providers in the area.

The results from our multivariate analyses enable us to provide directions or tendencies on possible answers to these research issues but because of the limited data that we had, these should not be taken as offering definitive conclusions. The most important but absent data was the cost of acquisition of equipment and other capital items, the omission of which would result in inefficient estimators. Biased estimates will also be obtained if the mentioned unit cost data were correlated to the other hypothesized determinants. However, it may be reasonably assumed that no single hospital would have monopsonistic power in the hospital equipment market. Thus, we do not expect the coefficients of hospital characteristics and other regressors to be diluted or biased by the omission of the cost variable.

Private vs. public hospital investment behavior. The results suggest that private hospitals should not be expected to manifest the same preferences like the government-owned facilities in their specific choice of hospital investment. Whereas government facilities preferred bigger beds as compared to private facilities, the latter are shown to have greater propensity to invest in the relatively advanced technology as exemplified by MRI, CT Scan and ultrasound compared to government facilties. The policy implications of this result are as follows.

First, as government attempts to extend further the

privatization of the hospital industry by turning over the operation of government facilities to cooperatives and other profit-oriented enterprises and by desisting from establishing new hospitals, the overall technological make-up of patient care in the country could also change, towards hospitals that are smaller bed-wise but bigger in terms of non-bed equipment.

Second, in areas where the private sector exist, monitoring hospital supply based on the number of beds alone could be misleading. Such indicators may have to be complemented by data on availability of equipment to have a better picture of the overall capacity to deliver hospital care in catchment areas. To date, the Bureau of Licensing and Regulations limits its regular hospital supply monitoring for municipalities, cities and provinces to the number of authorized hospital beds.

Third, a good follow-up issue which is not within the scope of this paper but nevertheless important in hospital planning is : does the the emerging allocation pattern of hospital investment, i.e., less "bed-intensive" but more "equipment -intensive" represent the optimal mix of capital inputs needed to meet the medical requirements of the population? What are the implications on hospital cost in the country and consequently on hospital prices ?

Effects of insurance. Another suggestion gathered from the results in this study is that hospitals with larger capital outlays are also those which obtained larger mark-ups from Medicare patients. This is contrary to the view from other studies (e.g., Griffin, et.al, 1992) that Medicare has in fact perversely affected hospital investment. Granted that the results here are not conclusive for reasons indicated above, note that the other studies have surmised the contrary idea from two-way tables without controlling for other possible causes, i.e., Medicare support values were negatively associated with hospital bed size because supossedly higher support rates were given to primary level facilities as compared to secondary and tertiary care facilties. Besides, capital spending is not merely limited to hospital beds; in fact, data for 1991 presented in this study show that more hospitals spent for acquisition and repair of medical equipment than those which spent for beds. Measuring hospital capital stock in terms of bed size becomes even more inappropriate for private tertiary hospitals.

As the government extends the coverage of the Medicare program, the question that this issue points to is : if capital spending in hospitals translates to higher cost per patient care, what would be the consequent effect on the cost of the Medicare program?

Our results also suggest that affiliation with private

financing schemes has seemingly no impact on the amount of capital outlays of the average hospital because of the small coverage they have provided so far. As this type of schemes further expand, it is not certain whether they remain unimportant in influencing capital spending.

Location charateristics and investment. Do hospitals respond to the epidemiologic characteristic of their catchment area? The results here hint that facilities located in provinces with poorer health status (as measured by infant mortality rate) spend more for capital relative to healthier provinces. This is true for both private and government hospitals. Since there are no direct assistance or subsidy given to private hospitals, the result here suggests that privately-owned hospitals could also respond to health needs without direct inducement from the government. An attendant issue, however, is whether the levels and types of capital spending by the private sector is adequate to meet the medical needs of the sick among the population. If not, what policy instruments may be considered?

It should be mentioned that hospitals in the NCR are the biggest in terms of average bed capacity and availability of equipment, and that technological diffusion in hospitals outside the area is relatively slow. The availability of such basic equipment as X-ray and ECG machines which are supposedly part of the minimum requirements for a hospital to be licensed by the government is lowest in the lesser developed provinces as Surigao del Norte and Cagayan. To the extent that this is caused by macroeconomic factors in the province, the issue that would have to be faced by government is : should it indirectly encourage investment by the private sector in areas of low health status and poor economic environment, or should it directly intervene by putting up the facility itself?

Two related issues that government also needs to address when it considers influencing private sector investment activity are the role of the centrally-determined criteria for hospital establishment, and the tariff rules for imported hospital equipment. First, the licensure policies of the BLR have not considered health needs based on indicators such as the IMR as their basis for approval/disapproval for expansion in a catchment area (see Appendix C). The policy assumes that health status across catchment areas does not vary so that an average hospital can be conceptualized at the national level. This average hospital is one that meets the criteria or minimum standards of the DOH. As available data show that the types of prevailing diseases and their incidence vary at least from province to province, this average hospital could not be expected to address effectively and adequately the medical needs of all population groups across the country. Thus, government may have to consider decentralizing licensure policies such that the average hospital will be more specifically focused towards the medical problem of the province at

the very least.

Second, the government's policy regarding importation of hospital equipment by private hospitals has favored the primary and secondary level facilities by granting them exemptions from payment of tariff duties although tertiary hospitals are required to pay. The policy implicitly assumes that there are diseconomies from adopting a more recent technology or from having bigger capacities thus, tertiary facilities are discouraged from further expanding. Since there are no evidences to support these, the policy may have to be reconsidered. Moreover, the fact that government policy also operates tertiary care facilities and that these are also exempt from payment of import duties would contradict the government's notion that there will be gains realized from limiting a tertiary facility in the private sector to expand.

Role of market structure. Do hospitals respond to competition by having more beds and equipment available? Results obtained here hint that hospitals located in municipalities where the bed capacity of other hospitals in the private sector is large, tend to have bigger bed capacities. However, the bed capacity of other hospitals in the government sector does not at all influence the bed size of the typical hospital (a private hospital). Also, the likelihood of investing in an X-ray diminishes as the size of the private hospital sector in the municipality expands; but the same decision is unaffected by the size of the government sector. Yet, a larger presence of the government sector correlates negatively with the acquisition of an ultrasound in the typical hospital.

These points out that hospitals do not tend to limit themselves to price competition in reaction to the presence of other providers in the area. Morover, the result of interaction via infrastructure (crowding-in or crowding-out) varies seemingly depending on the type of service and according to the type of the other provider in the area (whether private or public). Thus, policies for government hospitals that will expand or slow down their capacity, e.g., closure of facilities devolved to the local government units, could also impact on the growth of the private sector. In some localities, contraction in the government sector could yield an expansionary private sector activity while in other areas the reverse may hold. The governnment should therefore consider the consequences of such policies in a broader or market-wide perspective.

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Appendix Table A.1

Average Prices of Government and Private Facilities in Selected Provinces as of 1991

	Fee per discharge (P)	Fee per out-patient contact (P)
Government		
Primary	162.67	19.37
Secondary	182.35	17.05
Tertiary	870.67	21.50
Private		
Primary	924.06	143.4
Secondary	1318.54	115.84
Tertiary	4133.62	387.09

Source: PIDS-DOH Hospital Administrator Survey

Appendix Table A.2
Beds Size and Equipment Profile of Hospitals
in Selected Provinces as of 1991

Province	Average No. of Beds per Hospital	Percentage of Hospitals with			
		Xray	ECG	Ultrasound	MRI or CT Scan
Bohol	48	71.43	50.00	7.14	0
Cagayan	31	52.94	17.65	5.89	0
Cebu	69	66.67	54.17	20.83	12.5
NCR	152	87.01	80.52	51.95	10.39
Misamis Oriental	55	61.53	61.53	30.76	0
Quirino	47	66.67	33.33	0	0
Surigao del Norte	44	55.55	44.44	11.11	0

Source of basic data : PIDS-DOH Hospital Administrators Survey

Appendix Table A.3

Provincial Level Indicators

Province	Infant Mortality Rate, 1990 a/	Provincial Population 1990 a/	Total Hospital Beds as of 1991		1992 Mean Household Expendi-tures c/	% of Pop. with Hospital Care, 1992 c/
			Gov't b/	Private b/		
Bohol	32.00	948,315	492	207	36511	4.01
Cagayan	31.80	829,974	748	240	43964	4.91
Cebu	28.00	2,645,735	2,045	1718	51032	2.58
NCR	27.40	7,928,867	10,620	3158	88654	4.21
Misamis Oriental	20.0	865,051	580	426	37890	3.1
Quirino	23.80	114,132	160	240	34851	4.98
Surigao del Norte	20.00	425,978	445	60	36600	2.68

Sources:
a/ National Population Census, NSO
b/ 1991 BLR Masterlist, DOH
c/ 1993 PIDS-DOH Household Survey, PIDS

Appendix B

Functional Organization of DOH-Licensed Hospitals

Primary Hospitals

1. Administrative Service

2. Clinical and Ancillary Service

   2.1. General Medicine
   2.2. General Pediatrics
   2.3. Obstetrics
   2.4. Minor Surgery

3. Nursing Service

Secondary Hospitals

1. Administrative Service

2. Clinical Service

   2.1. General Medicine
   2.2. General Pediatrics
   2.3. Laboratory
   2.4. General Surgery

3. Medical Ancillary Services

   3.1. Anesthesia
   3.2. Radiology
   3.3. Laboratory
   3.4. Emergency and Out-Patient Service

4. Nursing Service

5. Dietetic Service

6. Engineering, Maintenance and Housekeeping Service

Tertiary Hospitals

1. Administrstive Service

2. Clinical Service

2.1. Department of Medicine

2.1.1. General Medicine
2.1.2. Cardiology
2.1.3. Gastroenterology
2.1.4. Hematology
2.1.5. Neurology
2.1.6. Infectious Diseases

2.2. Department of Pediatrics

2.2.1. General Pediatrics
2.2.2. Neonatology
2.2.3. Preventive Pediatrics
2.2.4. Infectious Diseases

2.3. Department of Surgery

2.3.1. General Surgery
2.3.2. Orthopedic and Traumatic Surge

2.4. Department of OB-Gyne

2.4.1. Obstetrics
2.4.2. Gynecology

2.5. E E N T Service

3. Medical Ancillary Service

3.1. Anesthesia Servise
3.2. Pathology Department
3.3. Radiology Department
3.4. Emergency and Out-Patient Service
3.5. Dental Service
3.6. Pharmacy Service
3.7. Medical Records Service

4. Nursing Service

5. Dietetic Service

6. Engineering, Maintenance and Housekeeping Service

Appendix C

Criteria for the Establishment of Hospitals
Bureau of Licensing and Regulations-Department of Health

1. The hospital bed to population ratio of the catchment area is 1:500 and above.

2. The minimum distance of the proposed hospital to an existing hospital is 2-3 kilometers except in depressed area with a geographical terrain not accessible by passable road network or separated by abody of water.

3. The proposed hospital must be accessible as a referral facility to a minimum of three (3) lower category health facilities in the catchment area.

4. Availability of the required skilled manpower who are willing to accept immediate employment as soon as the proposed hospital becomes operational.

5. The population to be served within the catchment area is at least 75,000 population.