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Evidence from the Guangdong hospital industry

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Soft budget constraints in China: Evidence from the Guangdong hospital industry

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Abstract. Using data from 276 general acute hospitals in the Pearl River Delta region of Guangdong Province from 2002 and 2004, we construct a preliminary metric of budget constraint softness. We find that, controlling for hospital size, ownership, and other factors, a Chinese hospital's probability of receiving government financial support is inversely associated with the hospital's previous net revenue, an association consistent with soft budget constraints.

1. Introduction

An organization's budget constraint can be said to be soft if the organization expects that financial difficulties will lead to bail out rather than liquidation or closure (Kornai 1986). An extensive theoretical and empirical literature applies the soft budget constraint concept to explain firm behavior in both established market economies and transitional economies, including China's industrial and financial sectors.[1] More recently, a few studies have applied the rubric of soft budget constraints to examine the behavior of hospitals and other health service providers, as discussed in the articles by Kornai and Shen et al. in this issue. However, virtually no studies empirically examine soft budget constraints at the intersection of these literatures: China's hospital sector. Studies have examined numerous determinants of Chinese hospital performance, including payment incentives, price regulation, ownership structure, and competition (for recent reviews, see Hu et al. 2008 and Eggleston et al. 2008); but none to date has quantified the extent of soft budget constraints among Chinese hospitals nor their impact on hospital performance. This article seeks to help fill that gap.

[1] See for example Bai and Wang (1998), Anderson et al. (2000), and the excellent review by Kornai, Maskin and Roland (2003). For studies of soft budget constraints in the industrial and financial sectors of China, see for example Wong (1986); Qian and Roland (1996); Xu (1997); Brandt and Zhu (2001); Li (2003); Ito (2006); and Li (2008).

This article is one in a series of studies on the hospital market in Guangdong Province.[2] The hospital data come from the Pearl River Delta area of Guangdong, one of the wealthier parts of the China with a rapid development of the private sector in the overall economy. Our data on over 200 public and private hospitals present an opportunity to provide evidence on soft budget constraints in the hospital industry, because it collects two years of information on each hospital's profit margin as well as the amount of financial support from the government, among other information. This longitudinal data allows us to directly test one aspect of the theory of soft budget constraints: that some organizations can expect financial support when they are in financial difficulty, and that expectation may lead to operational decisions that contrast with those made by counterparts not expecting a bail-out.

Our empirical analysis has two parts. In the first part, we use probit and ordered probit models to examine whether hospitals that were struggling financially in previous years were more likely to receive government financial support in subsequent years. In the second part, we divide hospitals into three categories based on the amount of government financial support they received. We use descriptive analysis to examine whether proxies for hospital quality, productivity, and financial arrangements for patient care differ depending on the category of financial support. Our results, although preliminary because of data limitations, do provide suggestive evidence that the larger government-owned hospitals in China probably enjoy soft budget constraints to a far greater extent than their smaller and privately-owned counterparts, and softness of budget constraint can have both positive and negative implications for hospital performance.

2. Data and Methods

2.1 Data and Sample

Given the focus on ownership in a companion paper (Eggleston et al. 2009), our sample was purposively constructed to over-sample the private sector. Specifically, the sampling frame included all private for-profit hospitals officially registered by 2002 in five cities: Guangzhou, Zhongshan, Panyu, Jiangmen, and Dongguan. A comparable selection of not-for-profit hospitals involved randomly choosing a specific number of hospitals within each category of the official Chinese classification system for hospitals. The analysis and conclusions must be interpreted

[2] See Eggleston et al. (2009) and Eggleston et al. (forthcoming).

with caution in light of the deliberate over-sampling of urban and semi-urban areas and private hospitals, and the quasi-random sample design. The data cannot be considered representative of the province as a whole, much less of China in general. However, given the dearth of data on soft budget constraints in China's health sector, this sample provides a snapshot with a broad range of hospital sizes and ownership structures that encompasses many of the market characteristics of China's vast and varied hospital sector.

Two waves of surveys were conducted for 2002 and 2004, in which detailed hospital utilization and financial information were collected, with a follow-up survey in 2005 to collect information on additional payment arrangement information for the same set of hospitals. Among the hospitals that responded to the survey, we exclude specialty hospitals and traditional Chinese medicine hospitals for this study. In addition, because our estimation of soft budget constraints requires at least two years of data, only hospitals that respond to both surveys are included. Our analytical sample includes 276 general acute hospitals that responded to the hospital survey in both waves.

2.2 Analytical Methods

Analysis of SBC. To answer the first research question -- whether hospitals that were struggling financially in previous years were more likely to receive government financial support in subsequent years -- we implement two types of econometric models. As a starting point, we estimate a probit model as follows:

$$\text{Prob}(Gov\_support_{i(t+1)} > 0 \mid x_{it}) = \Phi(Profit_{it}\beta_1 + x_{it}\beta_2)$$

where the dependent variable, $Gov\_support_{i(t+1)}$, is equal to 1 if the i^{th} hospital receives government financial support in year 2 of the survey and 0 otherwise; the key independent variable is $Profit_{it}$, the i^{th} hospitals' operating profit margin in year 1; and the rest of the control variables, described below, are captured by x_{it}. Our key coefficient of interest is β_1. The sign of β_1 gives an indication of the softness of the hospital's budget constraint. If β_1 is negative, this indicates that government financial support is more likely in year 2 if the hospital is experiencing lower profits (or greater losses) in year 1. We provide more details on the variables used in the model below.

- Government financial support: this refers to cash infusion by the government to pay for employee pensions, physical capital, and other types of monetary support not directly

- Profit margin: the profit margin is calculated as operating profit (i.e., patient revenue minus the operating cost) divided by operating cost. For ease of interpretation, we convert the continuous variable into a categorical variable representing the quartiles of the profit margin, and use the categorical variables in the model (with the lowest quartile being the reference group).
- Ownership: we control for whether the hospital is for-profit, not-for-profit, or government owned.
- Social insurance contract: Many hospitals (in particular, county hospitals) are designated hospitals for social insurance contract patients. These hospitals can care for patients enrolled in the government's social insurance program and receive reimbursement for such care. Note that this is separate from the government financial support described above which does not pay for patient care.
- Other hospital characteristics: we control for teaching hospital status. In addition, to capture the size of the hospital, we include total inpatient discharges in wave 1.
- County indicators: We also include dummy variables to capture potential differential support levels across different counties (Dongguan, Shenzhen, Zhuhai, Huizhou).

Second, we refine our dependent variables to capture three levels of government financial support. Specifically, we classify hospitals into three levels depending on the amount of government financial support they receive in wave 2 of the survey. Take model 1, for example: among the 276 hospitals in the sample, 109 are in category 1 and receive zero government support; 92 hospitals are in category 3 and receive, on average, 18,787,500 RMB yuan from the finance ministry. The remaining hospitals are in the middle category (moderate government support). For model 2, we classify hospitals in the same way but use government support from any government agency (not just from the finance ministry) as the base for the classification. Because the dependent variable now has 3 levels, we estimate an ordered probit model.

Association between government financial support and hospital operations. In the second half of the analysis, we use descriptive analysis to examine whether a hospital's quality,

productivity, and financial arrangement measures differ by the level of government financial support. Due to limited information (in particular, lack of good case mix control), we were not able to do a multivariate analysis for this portion of the study. Instead, we present descriptive statistics on different aspects of hospital operations, and use t-tests to compare the values between hospitals in categories 1 and 3. We focus on the following aspects of hospital operations:

- Quality proxies: we examine in-hospital mortality and the "curative ratio," defined as the percentage of discharged patients who were cured or whose conditions improved (a metric commonly collected and reported in China; no information is available for measures of process quality). These measures are imperfect proxies for outcome quality, especially because the data includes few variables to control for each hospital's case mix. Hospitals with a more severe case-mix will have higher mortality rates and lower curative ratios, even if they are providing exemplary quality of care. Thus our results must be interpreted with caution: they represent the health conditions of the patients the hospital attracts as much as the quality of the services the hospital provides.
- Productivity proxy: we examine occupancy rate, expenses per patient, number of patients per doctor per day, number of patients per nurse per day. These measures are only crude proxies for true productivity, which would measure the value of improved health outcomes compared to the resource use in achieving those outcomes. These metrics do however provide some useful information and are widely used in China.
- Financial arrangements for patient care. We examine two indicators of financial arrangements: whether the hospital allows patients to receive outpatient treatment before paying, and whether patients must prepay for inpatient hospitalization. Theory would suggest that hospitals with soft budget constraints might allow patients more lenient financial arrangements for accessing care (such as providing outpatient or inpatient services without up-front payment) because of the financial cushion from the government.

3. Results

The first column of Table 1 provides the descriptive statistics of the study variables included in the probit and ordered probit estimation model for the whole sample. On average,

two-thirds of hospitals receive some government financial support. The average operating margin is very low, at -15 percent. About 70 percent of hospitals are "appointed" for treating patients from the social insurance program. The Guangdong hospital industry is predominantly government run, even though we oversampled private hospitals—63 percent of hospitals are government-owned, 19 percent are for-profit, and the remaining 18 percent are not-for-profit hospitals. In the next two columns, we compare the same study variables between two sets of hospitals: those receiving no government financial support (i.e., presumably facing the hardest budget constraint) and those receiving generous government support (upper 1/3 of the government support distribution). As the columns show, hospitals with no government financial support tend to be smaller (as measured by visits and discharges), less likely to serve as social insurance contract hospitals or as teaching hospitals, and are predominantly private hospitals.

Table 2 presents the results of the probit estimation. As discussed in the methods section, we examine two types of government financial support and the results are very similar between the two models. We focus our discussion on Model 1 here. Take the comparison between hospitals in the lowest and the highest quartile of the profit margin distribution, for example: the coefficient of -0.332 indicates that the probability of receiving government financial support in wave 2 is 0.332 lower in hospitals with the highest profit margin compared to those in the lowest profit margin category (p-value<0.05). As Table 2 shows, the probability of receiving government financial support in wave 2 goes down gradually as hospitals move up the profit margin categories in wave 1, a finding that is consistent with the soft budget constraint theory. Note that the for-profit hospital indicator is dropped from Model 1, because, as Table 1 shows, none of the for-profit hospitals receive any government financial support (so it perfectly predicts the outcome).

Table 3 presents the results of the ordered probit estimation where we refine the dependent variable to be a 3-level category. We present the results as marginal effects for easier interpretation. As with the probit results, models 1 and 2 have similar patterns so we focus our discussion on Model 2 (bottom panel). The first column of Table 3 shows that the probability that hospitals will be in the lowest government support category increases as they move up the profit margin distribution. For example, hospitals in the highest quartile of the profit margin distribution have a 0.402 higher probability of being in the lowest government support category compared to hospitals in the lowest quartile ($p<0.01$). The second column shows that the

probability that a hospital will be in category 2 (moderate government support in wave 2) decreases by 0.148 if it moves from the lowest to the highest profit margin category. The magnitude of that marginal effect increases for category 3: the probability that a hospital will be in category 3 decreases by 0.254 if it moves from the lowest to the highest profit margin category ($p<0.01$). Note that the marginal effect (i.e., changes in predicted probability) across the three government support categories for each profit margin category should add up to zero.

We present our descriptive analysis on the relationship between government financial support and three dimensions of hospital operations in Table 4. (For clarity of presentation, we omit category 2 in the table but results are available from the authors upon request.) The first panel shows the comparison for quality proxies. There does not appear to be much difference between hospitals in different categories—those receiving the most government support have a bit higher curative ratio (0.77 vs. 0.84, $p<0.1$). But as mentioned in the methods section, this can mean both better quality as well as better case mix. To the extent that these large government hospitals are attracting a more severe case-mix, their better curative ratios indicate that financial support is protective of quality.

Turning to proxy metrics for productivity, we find that hospitals obtaining the most government support have higher occupancy rates and spend more per patient, but also have higher patient-to-staff ratios (the t-tests for all 4 measures are statistically significant at the 0.01 level). Lastly, in terms of financial arrangements for patient care, higher shares of hospitals receiving large government support allow patients to receive treatment before paying (0.55 vs. 0.77, $p<0.01$) but there is no difference in the requirement to prepay for inpatient hospitalization between the two categories.

4. Discussion

Numerous empirical studies have found evidence of soft budget constraints among China's industrial and financial firms, differing by sector, ownership, and over time (Wong 1986; Qian and Roland 1996; Xu 1997; Brandt and Zhu 2001; Li 2003; Ito 2006; and Li 2008). In this paper, we contribute to that literature by providing preliminary evidence regarding soft budget constraints in another important sector of China's transitional economy: hospitals.

Using data from 276 general acute hospitals in the Pearl River Delta region of Guangdong Province from 2002 and 2004, we construct a preliminary metric of budget constraint softness

based on the relationship between 2002 profit margin and 2004 government support. We find that, controlling for hospital size, ownership, and other factors, the probability of receiving government financial support is inversely associated with the hospital's previous net revenue. In other words, hospitals with larger losses are more likely to receive subsequent financial support from the government than otherwise similar hospitals with higher profit margins. These associations are consistent with soft budget constraints. Less clear is the impact of soft budget constraints on Chinese hospital behavior. Theory and empirical evidence from other countries suggest that soft budget constraints can contribute to inefficiency and slowness to innovate in quality, but also can help to assure access to services and mitigate the quality-shaving aspects of aggressive cost control (Kornai 2009; Shen and Eggleston 2009). Although we provide descriptive associations between the extent of government support and various proxies for hospital performance, the results are mixed and inconclusive.

Our results cannot be considered definitive for several reasons. We have longitudinal data spanning only two points in time. The aggregated hospital-level data does not allow us to control for patient case-mix at each hospital or examine patient-level impacts of hospital operational decisions. The sample is not representative of China's hospitals as a whole.

Despite these limitations, the empirical findings provide suggestive evidence that the larger government-owned hospitals in China probably enjoy soft budget constraints to a far greater extent than their smaller and privately-owned counterparts. Further research identifying plausibly exogenous variation in the softness of budget constraints facing health service providers, and the implications for provider performance, would be valuable both to inform policy making during China's ongoing health system reforms and to deepen understanding of financial accountability and organizational performance in different institutional contexts.

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Table 1. Hospital Characteristics by Degree of Government Financial Support

(Standard deviations in parentheses)	Whole Sample	Lowest gov support in wave 2 (lower 1/3 of distribution)	Highest gov support in wave 2 (upper 1/3 of distribution)	
Hospital finance and size				
Share of hospitals receiving gov support	0.61	0.00	1.00	**
from finance ministry in wave 2	(0.49)	0.00	0.00	
Amount of gov support from finance ministry	645.34	0.00	1878.75	**
in wave 2 (in 10000 yuan)	(1482.25)	0.00	(2080.17)	
Share of hospitals receiving gov support	0.68	0.20	1.00	
from any government body in wave 2	(0.47)	(0.40)	0.00	
Amount of gov support from any gov agency	721.39	101.06	1981.77	
in wave 2 (in 10000 yuan)	(1571.20)	(330.77)	(2217.61)	
Total operating profit margin in wave 1	-0.15	-0.08	-0.14	
	(1.34)	(0.83)	(0.20)	
Total outpatient visits in wave 1	252223	104875	433298	**
	(339026)	(158542)	(455780)	
Total inpatient discharges in wave 1	4211	1697	7413	**
	(5796)	(3228)	(7343)	
Other Hospital Characteristics				
Designated social insurance contract hospital	0.70	0.50	0.88	**
	(0.46)	(0.50)	(0.33)	
Not-for-profit hospital	0.19	0.42	0.03	**
	(0.39)	(0.50)	(0.18)	
For-profit hospital	0.18	0.45	0.00	**
	(0.38)	(0.50)	0.00	
Government hospital	0.63	0.13	0.97	**
	(0.48)	(0.34)	(0.18)	
University hospital	0.05	0.02	0.10	*
	(0.21)	(0.13)	(0.30)	
Guangzhou county	0.45	0.44	0.47	
	(0.50)	(0.50)	(0.50)	
Dongguan county	0.16	0.13	0.02	
	(0.37)	(0.34)	(0.15)	
Shenzhen county	0.24	0.24	0.41	**
	(0.43)	(0.43)	(0.50)	
Zhuhai county	0.05	0.04	0.05	
	(0.22)	(0.19)	(0.23)	
Huizhou county	0.08	0.08	0.04	
	(0.27)	(0.28)	(0.21)	
Observations	276	109	92	

The last column indicates whether the difference (between hospitals with the lowest government support and those in the upper third of the government support distribution) is statistically significant at + <0.1 * <0.05 **<0.01 levels.

Results for the middle level of government support are available upon request.

Table 2. Probit Results: Determinants of Receiving Government Financial Support

	(1) Receives government support (caizheng buzhu) in wave 2	(2) Receives support from any gov agency in wave 2
(Standard errors in parentheses)		
Operating profit margin from wave 1 (lowest quartile, reference group)	--	--
Profit margin 2nd quartile	-0.141	-0.102
	(0.160)	(0.123)
Profit margin 3rd quartile	-0.187	-0.106
	(0.147)	(0.107)
Profit margin 4th quartile	-0.332*	-0.263*
	(0.156)	(0.123)
Have social insurance contract	0.170	0.087
	(0.130)	(0.085)
Government hospital	0.870**	0.553**
	(0.040)	(0.083)
For-profit hospital		-0.420**
		(0.137)
University hospital	-0.239	-0.051
	(0.252)	(0.215)
Dongguan county	-0.259	-0.216
	(0.158)	(0.142)
Shenzhen county	-0.029	-0.007
	(0.143)	(0.087)
Zhuhai county	0.248+	0.155*
	(0.134)	(0.074)
Huizhou county	0.094	0.093
	(0.191)	(0.108)
Inpatient discharges in wave 1 (in 1000s)	0.012	0.020*
	(0.010)	(0.010)

+ significant at 10%; * significant at 5%; ** significant at 1%

Table 3. Ordered Probit Results: Marginal Effect of Profit Margin on Probability of Hospitals in 3 Government Support Categories

Change in probability (SE)	Prob[Gov support lower 1/3]	Prob[Gov support middle 1/3]	Prob[Gov support upper 1/3]
Model (1) Receive financial support from finance ministry			
Operating profit margin from wave 1 (lowest quartile)	--	--	--
Profit margin 2nd quartile	0.132	-0.059	-0.073
	(0.096)	(0.052)	(0.047)
Profit margin 3rd quartile	0.255*	-0.129*	-0.126**
	(0.100)	(0.065)	(0.043)
Profit margin 4th quartile	0.389**	-0.214**	-0.175**
	(0.110)	(0.082)	(0.044)
Model (2) Receive financial support from any government agency			
Operating profit margin from wave 1 (lowest quartile)	--	--	--
Profit margin 2nd quartile	0.138+	-0.026	-0.112*
	(0.081)	(0.031)	(0.057)
Profit margin 3rd quartile	0.218**	-0.056	-0.162**
	(0.085)	(0.043)	(0.053)
Profit margin 4th quartile	0.402**	-0.148*	-0.254**
	(0.094)	(0.065)	(0.050)

Table 4. Hospital Characteristics by Degree of Government Financial Support

(Standard deviations in parentheses)	Whole Sample	Lowest gov support in wave 2 (lower 1/3 of distribution)	Highest gov support in wave 2 (upper 1/3 of distribution)	
Hospital quality / productivity / payment option measures in wave 2				
Quality Proxy				
In-hospital mortality	0.02	0.01	0.02	
	(0.03)	(0.03)	(0.02)	
Curative ratio	0.79	0.77	0.84	+
	(0.27)	(0.33)	(0.17)	
Productivity Proxy				
Occupancy rate	0.60	0.42	0.75	**
	(0.35)	(0.34)	(0.26)	
Total expense per patient (in yuan)	198.73	178.75	253.61	**
	(137.42)	(154.44)	(122.24)	
Patients per doctor per day	11.65	7.56	11.08	**
	(15.20)	(6.09)	(7.10)	
Patients per nurse per day	14.94	9.46	13.49	**
	(25.77)	(8.83)	(10.27)	
Financial arrangements for patient care				
Allow patients to receive outpatient	0.68	0.55	0.77	**
treatment before paying	(0.47)	(0.50)	(0.42)	
Inpatients must prepay for hospitalization	0.94	0.90	0.95	
	(0.24)	(0.30)	(0.21)	
Observations	276	109	92	

The “curative ratio” is defined as the hospital's self-report of the percentage of discharged patients who were cured or whose conditions improved. The last column indicates whether the difference (between hospitals with the lowest government support and those in the upper third of the government support distribution) is statistically significant at + <0.1 * <0.05 **<0.01 levels.

Results for the middle level of government support are available upon request.