JOHNS HOPKINS
CAREY BUSINESS SCHOOL

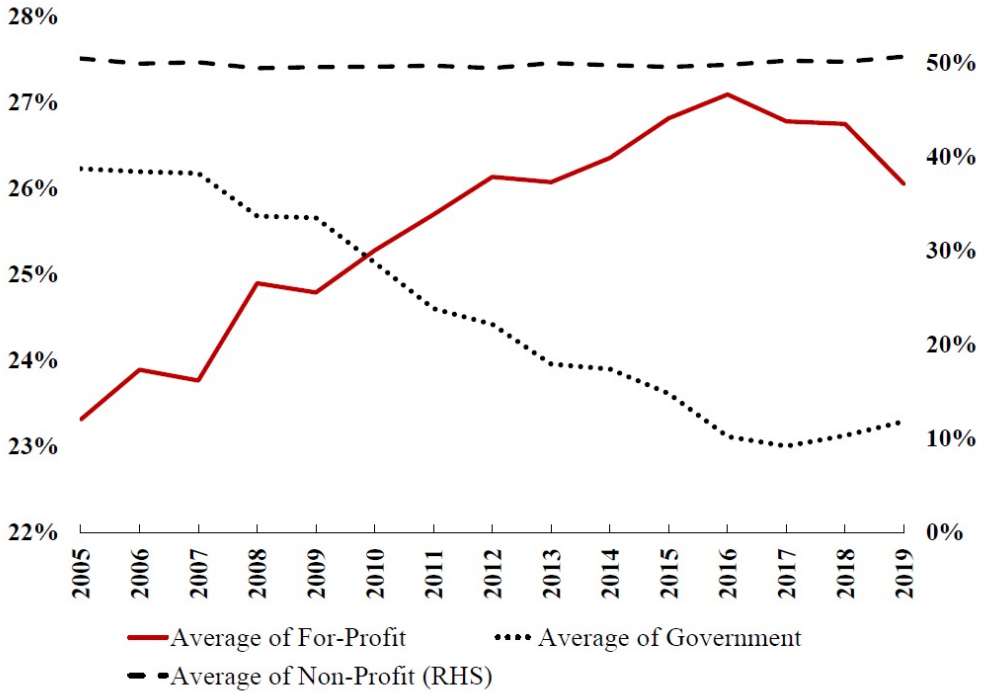
The Financial Fragility of For-profit Hospitals: Evidence from the COVID-19 Pandemic

Ge Bai, Daniel Jimenez, Phil Phan, Luis Quintero, Alessandro Rebucci, and Xian Sun

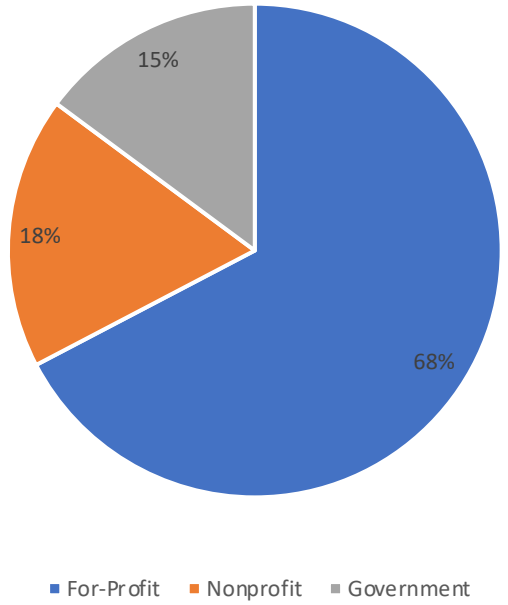
January, 2022

Share of for-profit hospitals increased during 2007-2016; for-profit hospitals focus on specialty care

Figure 1: HOSPITALS BY OWNERSHIP TYPE: 2005-2019

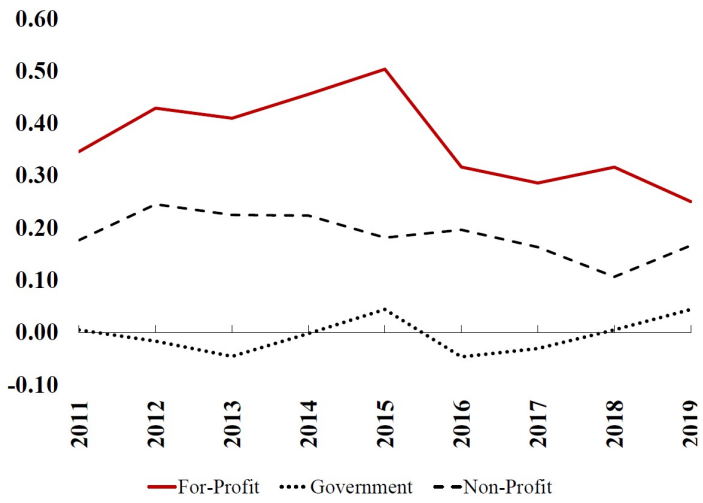


Distribution of Specialty Hospitals by Ownership

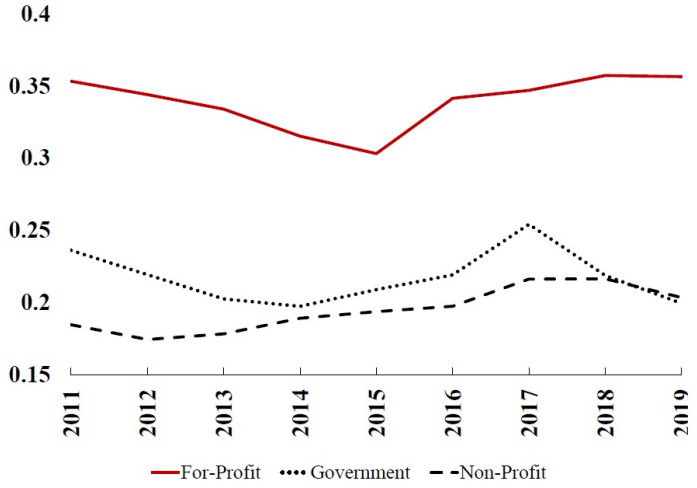


For-profit hospitals are more profitable but also more risky

Panel A: Average Return on Assets



Panel B: Return on Asset Volatility



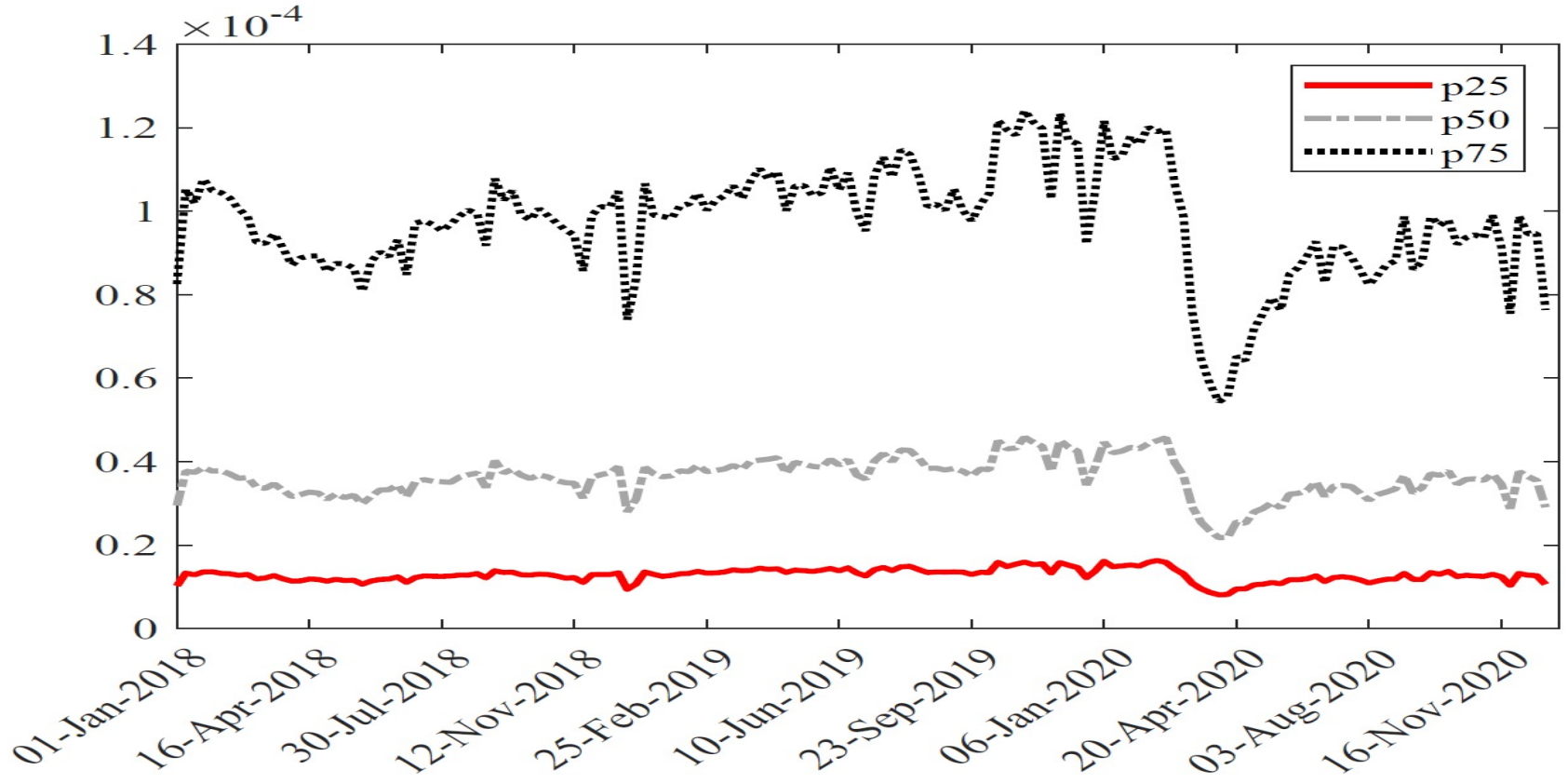
This paper

- Studies how variation in hospital ownership affects the likelihood of financial distress in response to an aggregate shock and discusses implications for service provision.

- Uses high frequency mobility data to predict operational variables that typically affect financial performance.

- Provides a framework to inform policy interventions to support hospitals when needed

Covid-19 is major aggregate shock with ex ante ambiguous effect on hospitals' operations



(a) Sample 1

We find that

- Our mobility-data-based predicting framework forecasts as well as actual data in 2018-2019
- The probability of financial distress of for-profit hospitals in 2020 increased much more than non-profit and government hospitals
- This potentially threatens the service provision of specialty care, especially mental health and rehabilitation services on which for profit hospitals specialize

Roadmap

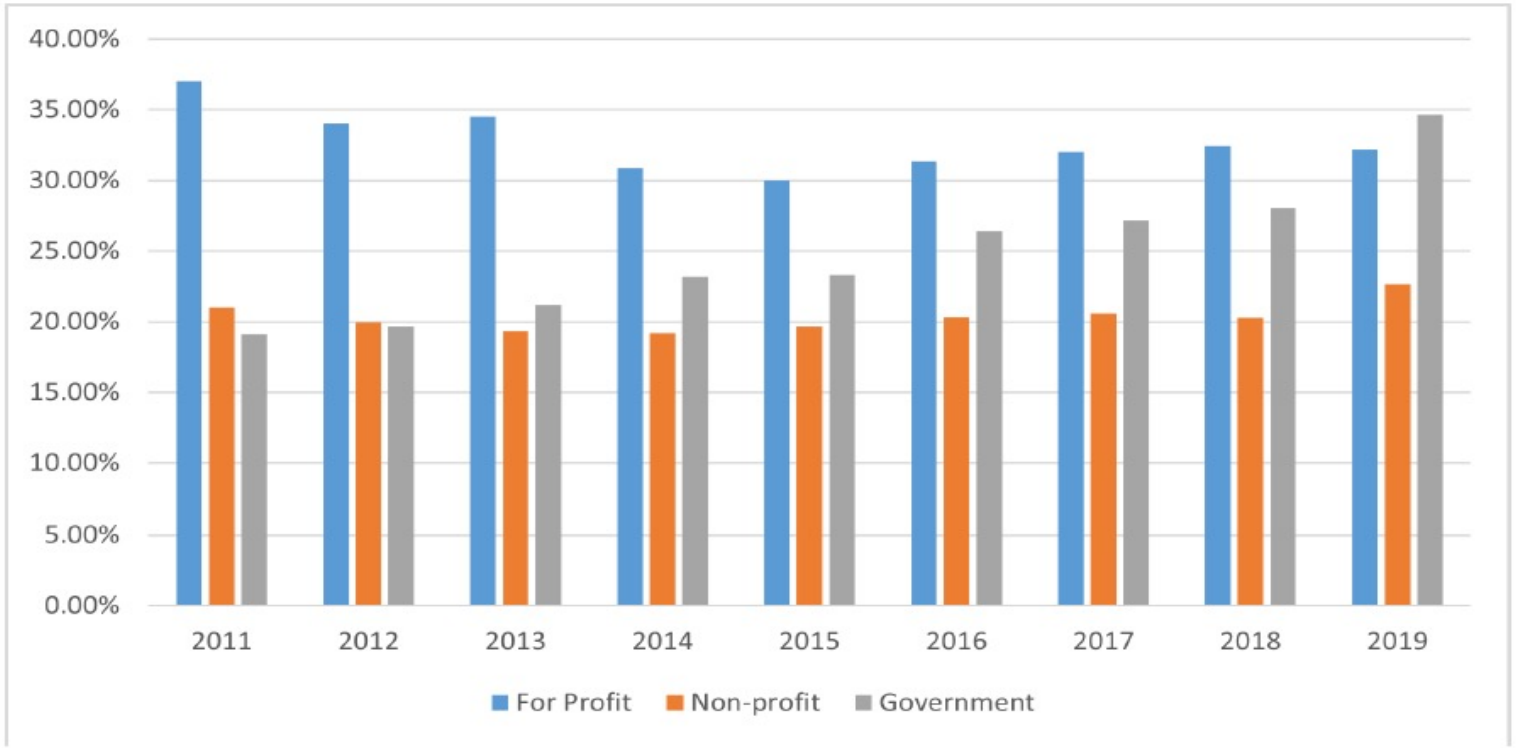
- Methodology
- Data
- Results
- Implications
- Conclusions

Methodology

- We proceed in four steps:
  - First, calculate the Altman Z-score and identify hospitals in financial distress between 2011 and 2019
  - Second, estimate a logit model that explains financial distress as a function of operational variables
  - Third, use daily mobility data on visits to healthcare facilities to predict critical operational variables in 2020
  - Fourth, combine the estimated logit parameters from step 2 with the 2020 forecasted values of hospital operational indicators from step 3 to predict the probability of hospital financial distress in 2020.

Step 1:
Financial Distress by Ownership Type

Figure 3: Percentage of Hospitals in Financial Distress by Ownership Type.



Note. This figure shows the percentage of hospitals classified financially distressed if the z-score is at or below 1.8 by ownership type.

Step 2:
Operating Variables and Hospital Financial Distress

Table 1: Logit Modeling of Hospital Financial Distress

Variables	(1)	(2)	(3)
For-Profit	0.612***	0.363***	0.363***
	(20.26)	(11.10)	(11.09)
Government	0.256***	0.176***	0.176***
	(8.28)	(5.06)	(5.05)
Inpatient surgeries		-0.0556**	-0.0571**
		(-2.18)	(-2.24)
Outpatient surgeries		0.0511**	0.0516**
		(2.31)	(2.33)
Inpatient days		-0.444***	-0.441***
		(-7.61)	(-7.58)
Emergency room visits		0.108***	0.105***
		(5.17)	(5.01)
Outpatient visits		0.0366**	0.0398**
		(2.30)	(2.49)
Outpatient revenues (%)		-1.566***	-1.623***
		(-15.83)	(-16.24)
Teaching		0.336***	0.345***
		(4.73)	(4.84)
Rural		-0.271***	-0.277***
		(-7.67)	(-7.82)
Hospital beds		0.621***	0.640***
		(6.79)	(7.00)
Full-time employees		-1.129***	-1.169***
		(-14.34)	(-14.73)
Full-time physicians		0.151***	0.166***
		(6.15)	(6.69)
Airborne isolation		-0.0690**	-0.0604**
		(-2.46)	(-2.15)
Air rooms		-0.00854***	-0.00877***
		(-6.17)	(-6.30)
System		0.170***	0.162***
		(6.21)	(5.91)
Constant	-0.880***	3.011***	3.056***
	(-11.53)	(16.20)	(16.30)
Year effects	Yes	No	Yes
Service type effects	Yes	Yes	Yes
State effects	Yes	Yes	Yes
Pseudo-R2	0.0523	0.0743	0.0751
P>chi2	0.000	0.000	0.000
N	49718	49420	49420

- Controlling for operating variables and hospital characteristics, the indicator of for-profit and government hospitals still significantly relates to financial distress positively.
- The five operating variables all show significant relationship with hospital financial distress.

ty of For-Profit Hospitals

Step 2 (Cont.): Financial Distress by Ownership Type

Table 10: Logit Modeling of Hospital Financial Distress by Ownership Type

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	For-Profit		Non-profit		Government	
Inpatient surgeries	-0.165***	-0.192***	-0.0417	-0.0356	-0.119**	-0.0867
	(-3.63)	(-4.14)	(-0.98)	(-0.84)	(-2.09)	(-1.52)
Outpatient surgeries	0.0964***	0.119***	0.0420	0.0399	-0.000509	-0.0292
	(2.76)	(3.35)	(1.10)	(1.04)	(-0.01)	(-0.55)
Inpatient days	-0.636***	-0.622***	-0.617***	-0.623***	-0.388***	-0.362***
	(-4.87)	(-4.74)	(-6.59)	(-6.66)	(-3.40)	(-3.19)
Emergency room visits	0.156***	0.159***	0.0196	0.0180	0.172***	0.211***
	(5.60)	(5.68)	(0.52)	(0.47)	(2.60)	(3.09)
Outpatient visits	0.0623***	0.0584***	0.105**	0.109***	-0.0578	-0.0543
	(3.17)	(2.97)	(2.52)	(2.62)	(-1.25)	(-1.14)
System	-0.269***	-0.266***	0.296***	0.285***	0.285***	0.258***
	(-4.70)	(-4.64)	(7.67)	(7.36)	(4.37)	(3.94)
Constant	3.021***	3.120***	4.054***	4.140***	3.078***	2.947***
	(8.67)	(8.89)	(13.06)	(13.22)	(7.77)	(7.31)
Year effects	No	Yes	No	Yes	No	Yes
Service type effects	Yes	Yes	Yes	Yes	Yes	Yes
State effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.0597	0.0610	0.0887	0.0893	0.138	0.148
P>chi2	0.000	0.000	0.000	0.000	0.000	0.000
N	13743	13743	26058	26058	9503	9503

- While hospital service supply disruptions due to the lockdowns may have harmed patients' in need for non-COVID-19 medical care, it has not necessarily hurt hospitals' financial health equally.
- For example, for-profit hospitals rely significantly on inpatient surgeries and inpatient days to lower financial distress.

Step 3: Mobility-data predict as well as or better than actual data in 2018-19

LOGIT ANALYSIS USING ALTERNATIVE PREDICTING REGRESSIONS AND MATCHED SAMPLES

	Benchmark: Column 3 in Table 3	**Traffic Model P1S1**	**Traffic Model P2S1**	**Traffic Model P3S1**	**Traffic Model P1S2**	**Traffic Model P2S2**	**Traffic Model P3S2**	**Traffic Model P1S3**	**Traffic Model P2S3**	**Traffic Model P3S3**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Actual Operational Indicators	Yes	No	No	No	No	No	No	No	No	No
Mobility Pred. Operational Indicators	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.075	0.080	0.080	0.080	0.081	0.081	0.081	0.102	0.102	0.103
P>chi2	0	0	0	0	0	0	0	0	0	0
N	10,256	8,196	8,196	8,196	7,967	7,967	7,967	6,183	6,183	6,183

Step 4: An Example

$$\begin{aligned}
&\text{Est. logit value of hospital A} = \text{constant} + \text{state fixed effect} + \text{service code fixed effect} \\
&- 0.119 * \text{inpatient surgeries} + 0.0001 * \text{outpatient surgeries} \\
&- 0.388 * \text{inpatient days} + 0.172 * \text{emergency room visits} - 0.0578 * \text{outpatient visits} \\
&- 1.738 * \text{outpatient revenue}(\%) + 1.118 * \text{teaching} - 0.056 * \text{rural} \\
&- 0.160 * \text{hospital beds} - 0.362 * \text{full-time employees} + 0.184 * \text{full-time physiscians} \\
&- 0.346 * \text{airborne isolation} - 0.00364 * \text{air rooms} + 0.285 * \text{system},
\end{aligned} \tag{7}$$

We then convert the estimated logit value, in this example -0.384, to a probability of distress. Thus, for this particular hospital record, we predicts that the likelihood or probability of financial distress (defined as a z value below 1.8) in 2020 is 40.5%.

Main result: predicted Financial Distress in 2020

Table 2: Predicted Financial Distress in 2020

	2018 Observed	2019 Observed	2020 Predicted
All Hospitals	25.15%	28.09%	28.53% (1.63%)
For-Profit	32.44%	32.20%	39.13% (1.40%)
Non-profit	20.27%	22.64%	23.64% (1.07%)
Government	26.82%	32.11%	27.34% (2.70%)

Predicted Financial Distress in 2020 by Service Type

Table 3: Predicted Financial Distress in 2020 by Hospital Service Code

Service type	Service code	Hospitals	Distress Prob.	Total outpatient visits received in 2019
General medical and surgical	10	3,597	25.17%	590,065,101
Psychiatric	22	336	50.62%	4,653,985
Acute long-term care hospital	80	237	49.12%	1,044,597
Rehabilitation	46	191	32.40%	3,465,085
Surgical	13	76	17.62%	1,346,334
Children's general	50	46	17.20%	18,300,958
Orthopedic	47	26	13.84%	848,475
Children's psychiatric	52	13	61.81%	80,582
Heart	42	13	14.89%	832,068
Children's orthopedic	57	11	74.19%	193,893
Other specialty treatment	49	10	34.22%	443,075
Children's rehabilitation	56	8	45.02%	223,049
Alcoholism and other chemical dependency	82	8	27.55%	184,488
Obstetrics and gynecology	44	8	18.38%	1,314,318
Cancer	41	6	30.16%	867,851
Children's other specialty	59	5	7.75%	295,877
Intellectual disabilities	62	2	70.64%	0
Children's chronic disease	58	1	26.86%	33,018
Eye, ear, nose and throat	45	1	4.55%	412,346
Tuberculosis and other respiratory diseases	33	1	3.09%	112,251
Chronic disease	48	1	2.96%	7,450

Conclusions

- To predict financial distress in 2020 before actual hospital operational data become available, we propose to use of smartphone mobility data as predictors of hospital operational indicators.
- The framework forecasts hospital financial distress in sample as well as or better than with actual data for 2018 and 2019.
- For-profit hospitals are disproportionately affected by the COVID shock in 2020
- Since for-profit hospitals are the main providers of specialty health care services, such as psychiatric and acute long-term care, their increased financial distress can potentially result loss of specialty care service provision.

Build for what's next™