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An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
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Abstract

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This paper investigates the effect of a private equity leveraged buyout (LBO) on acute care hospitals. The LBO is a specific, yet increasingly common approach that private equity firms use to finance the purchase of healthcare firms. The usage of high debt and focus on short term results raises concerns of potential reduction in the quality of healthcare provided. Using empirical data and models, this paper studies the effect undergoing an LBO on heart failure, pneumonia, and acute myocardial infarction mortality rates. The findings of this study show that undergoing an LBO appears to increase mortality rates for both heart failure and pneumonia patients, but not for acute myocardial infarction patients.

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I. Introduction

Today, private equity firms make up a substantial volume of investors in the U.S. healthcare sector. While they have traditionally avoided involvement in the healthcare industry, high returns on investment have led private equity firms to increase their stake in healthcare, investing over $46 billion in 2019, a 58% increase from 2018 (Bain, 2019; Deutsche 2006). In particular, private equity firms have focused their investments on more mature and established healthcare firms that have less risk than early-stage businesses, such as the purchase of HCA for $32 billion and Manor-Care for $6 billion (Robbins et al. 2019). As private equity interest in ownership of healthcare firms increases, so do the number of concerns about the effects on value proposition and healthcare quality.

Proponents of the recent uptick in private equity demand in healthcare have argued that private equity firms bring innovation to healthcare through new delivery models, technology, and operational efficiencies, taking advantage of a fragmented healthcare system and operational inefficiencies (Harvard, 2012). In addition, private equity firms typically have support from credible consultants, accountants, and diligence firms to quickly realize inefficiencies and implement solutions effectively (Becker, 2019). Critics of private equity investment in healthcare often cite their short-term involvement with the entities they take over and their dominating obligations to their shareholders and lenders, who are primarily incentivized by and expect substantial financial returns (Kim, 2012; Becker, 2019). The goals of private equity, mainly short-term involvement and generation of high rates of return, are most often achieved through the rapid improvement in financial performance followed by liquidation (Harvard, 2012). Addressing the concern that the goals of private equity firms may put those of traditional healthcare at risk, there has been substantial work showing that mergers and consolidations of healthcare systems into monopolistic entities increase hospital prices to patients as well as adverse patient outcomes (Gaynor et al. 2013; Haas-Wilson and Garmon, 2011; Tenn, 2011; Thompson, 2011). Generally, the consensus amongst these studies shows that the privatization of hospitals often leads to adverse healthcare outcomes. Despite these findings, empirical work on the issue remains limited, specifically examining the effect that private equity ownership of a hospital has on patient outcomes, beyond the "merger-and-consolidation" means of acquisition.

Increasingly, private equity firms have turned to leveraged buyouts (LBOs) to finance their acquisitions of large healthcare chains. More specifically, an LBO is a specific financial strategy that uses a high percentage of debt to purchase a controlling percentage of a company, thereby taking over its assets and operations. The cash flows generated from the assets are then paid out to shareholders over investment back into the hospital. Ultimately, the high usage of debts from lenders results in an additional concern regarding the potential reduction in quality due to an increased incentive to cut costs to meet debt repayment deadlines. Despite these concerns, there remains limited research on the effects of undergoing a leveraged buyout on product quality and, ultimately, patient outcomes.

Understanding the effects of undergoing a leveraged buyout on patient outcomes is critical in determining whether private equity involvement in the healthcare field through LBOs can provide a more efficient revenue-generating business proposition without decreasing patient outcomes. In this paper, I provide evidence for how patient mortality rates for pneumonia, heart failure, and acute myocardial infarction respond to hospitals undergoing an LBO, focusing specifically on acute care hospitals. Our analysis draws data from the Center for Medicare & Medicaid Services (CMS) hospital compare data, a yearly report of Medicare-certified hospitals from 2007-2018, which allows for longitudinal analysis of risk-adjusted patient mortality rates. Identification of hospitals that underwent an LBO was done through Pitchbook, and identification of acute care hospitals that did not undergo an LBO was achieved through the nearest non-for-profit hospital in the same county as an identified LBO hospital. I then specified my data into a balanced panel, identifying the causal effect of undergoing an LBO on acute care hospital mortality rates through a fixed effect OLS regression. Often, especially in the cases of smaller sample sizes, the standard errors are often drastically underestimated due to heteroskedasticity and serial correlation (Bertrand, Duflo and Mullainathan, 2003; Nickell 1981). In order to account for any potential confounding effects that may arise from heteroskedasticity and serial correlation, I use cluster robust standard errors. I also consider the effects of increased variances in early reports by CMS on pneumonia mortality rates through a sensitivity analysis. The motivation for a sensitivity analysis arises out of CMS' annual measures updates and specification reports, which provides updates as to which covariates are being included in heart failure, acute myocardial infarction, and pneumonia admissions. It is rare for specifications to remain unchanged in the categorization of admission under acute myocardial infarction, and pneumonia between years, which has a direct impact on mortality rates. Through my empirical analysis on mortality rates, I find that undergoing an LBO in an acute care hospital significantly increases mortality rates for heart failure and pneumonia patients, but not for acute myocardial infarction.

II. Related Literature

There has been a substantial amount of research studying the differences in patient outcomes between private for-profit and private not-for-profit hospitals, yielding mixed results. Researchers have looked at differences in mortality rates as averages across years, running regressions to determine the effects of privatization on hospitals on patient mortality rates. Devereaux et al. 2002 summarizes a large portion of research on privatization on mortality rates through a pooled metanalysis of 14 different studies, concluding that private for-profit has slightly higher mortality rates than not-for-profit hospitals.

However, the studies used in the metanalysis primarily draw from data in the late 1900s. More recent literature using updated data and taking into account additional metrics of healthcare quality such as patient experience scores, process quality, and accountability measurements show negligible differences in healthcare quality between for-profit and not-for-profit hospitals (Harvard, 2012; Cheney 2016). Highlighted differences in patient mortality then seem to be driven by the consolidation of hospitals that follow for-profit acquisition. There is a large body of research that highlights increases in inpatient mortality and cost to patients that come from such monopolistic effects and reduced competition (Wilson, Garmon (2011); Kessler, McClellan (1999); Capps et al. 2004). However, there has been little empirical work done on the effect private equity has on healthcare outcomes outside of a changing market scale scope.

Clues as to the effect private equity may have on patient mortality can then be analyzed through a financial lens. Kim and McCue (2012) evaluate the financial and operational performance changes for one of the largest LBO to date, the LBO of the Hospital Corporation of

America (HCA) in 2006. In their paper, they find that undergoing the LBO led to significant increases in cash flow margin, and net patient revenues for HCA. Furthermore, the LBO of HCA significantly increased operating expenses, but was also not associated with changes in labor costs and capital investment. In relation to patient mortality, there are reasons to believe that undergoing an LBO may provide a reduction in inpatient mortality, as an increased hospital financial performance is often highly correlated with hospital quality and safety performance (Akinleye et al., 2019). However, because of the financial structure of LBOs, revenues from cash flows are paid out to shareholders instead of being reinvested into the hospital themselves. Our study then offers a novel and direct empirical method of evaluating the effect undergoing an LBO has on patient mortality.

III. Data

The following data was assembled from the Center for Medicare & Medicaid Services (CMS) hospital compare (HC) database. The CMS HC database includes hospital characteristics and mortality reports that date back to 2005, filled out by Medicare-certified hospitals in the U.S. I also assembled hospital characteristic data from the National Bureau of Economic Research’s (NBER’s) Hospital Cost Report Information System (HCRIS) Database and the American Hospital Directory. The identification of LBO hospitals was achieved through usage of the financial reporting website, Pitchbook.

A. Variable Selection

For this study, I focused on the reported risk-adjusted mortality rates for each year, ignoring any calculation mechanisms that might have varied from year to year. The dependent and measurable variables used to measure patient mortality include 30-day risk-adjusted mortality rates for acute myocardial infarction, heart failure, and pneumonia. The summary statistics for these dependent variables are included in Table 2 below.

Additionally, I selected independent variables that were of importance to the study. The hospital characteristics of interest include: (1) number of beds in the hospital; (2) and, most importantly, the hospital's LBO status. In addition, I used the hospitals' CMS certification number (CCN) as a unique identifier for each hospital over time.

Summary statistics on the number of beds can also be found in Table 1 below. For the summary statistics, hospitals were split into two groups: the treatment group (1= LBO in 2010 hospital) and the control group (0 = Non-LBO Hospital). In addition to summary statistics, Table 1 demonstrates a preliminary difference-in-differences using the averages over pre- and post-LBO time frames.

Table 1. Summary Statistics for LBO versus Non LBO Hospitals: Pre-2011 and Post-2011

Year Range	2005-2010		2011-2018		Difference 2011:2018 and 2005:2010		Diff-in-Diff
LBO Group	1	0	1	0	1	0	
30-day Heart Failure Mortality Rate	11.1 [1.59]	10.5 [1.84]	11.2 [1.39]	10.4 [1.76]	0.07	-0.15	0.22
30-day Pneumonia Mortality Rate	14.0 [2.83]	13.7 [2.48]	14.8 [2.26]	13.9 [2.32]	0.83	0.27	0.56
30-day Heart Attack Mortality Rate	14.0 [1.29]	13.6 [1.27]	13.3 [1.14]	12.8 [1.00]	-0.72	-0.78	0.058
Number of Beds	176 [63.9]	389 [274]	181 [65.5]	406 [305]			
# of Reports by LBO Status: 1832	397	438	486	511			
# of Reports : 1832	835		997				
Cumulative Frequency: 100%	45.58%		54.42%				

1 = LBO Group, 0 = Non LBO Group
LBO group contains all hospitals that would eventually undergo an LBO in 2011
Mean reported on top
[Standard Deviation] reported on bottom

B. Dataset Construction

I organized and analyzed the dataset in R, refining the mass of data compiled in the CMS HC database to the values that would be important to my research question. The final data consist of CMS reports starting in 2008, when mortality rates were released for heart failure and acute myocardial infarction, and pneumonia. \

After identifying important values from the CMS HC database, I pulled values from each year's set of data that I believed was relevant to this study. On the CMS HC database, mortality rates are reported as 3-year averages. In order to obtain annual estimates of mortality rates, I weighted each mortality rate year by its overlapping mortality rate reports. For example, in order to estimate the 30-day risk-adjusted mortality rate for the 2014-2015 fiscal year, I equally weighted the reported mortality rates in 2017, 2016, and 2015; the mortality rates reported in these fiscal years account for estimates from 2017-2017, 2013-2016, and 2012-2015 respectively. In addition to important hospital data, I also used report specific information to remove any duplicate reports by the same hospital. Often there would be multiple update files and would subsequently lead to a hospital completing multiple reports in one year. Using the CCN as a unique identifier and hospital reporting date, I kept the hospital report information submitted latest in the given fiscal year, thereby dropping any duplicates submitted earlier that year by the same hospital. Merging the information from the HCRIS database, I obtained a comprehensive database for each year that contained hospital characteristics and information on hospital mortality rates. The final dataset was created by appending the data from 2008 to 2018, but through 3-year mortality rates, my final dataset includes mortality rates estimates from 2005-2017.

My analysis attempts to examine the effects LBOs would have on the most common type of hospital in the U.S. Therefore, I restrict my dataset to only include acute care hospitals, which account for 85% of all hospitals. I further removed extremely small hospitals with 25 or fewer beds to remove Critical Access hospitals (CAH).

Hospitals that underwent an LBO were determined through Pitchbook, as well as through company websites, and were sorted to only include acute care hospitals.

Hospitals that never underwent an LBO were determined by the closest not-for-profit acute care hospital to the LBO in the same county, provided that these hospitals did not undergo an LBO later. Furthermore, I restricted the sample period only to include hospitals that underwent an LBO in 2010 or never underwent an LBO. This condition is imposed to avoid the contamination of time-vary effects of LBO's in my covariates. Nevertheless, it is not very restrictive: of acute care hospitals in my full dataset that underwent an LBO, 90% of them did so in 2010. The reasoning for the high deal volume in 2010 can be explained in part by credit conditions (Axelson et al. 2013). Following the 2007-2008 Financial Crisis, borrowing rates were at an all-time low, allowing for private equity firms to obtain high amounts of debt at low-interest rates.

In order to reduce variation in hospital-specific data due to the varying number of reports per year, I created a balanced panel out of my data. In effect, this includes only hospitals that completed all 12 years of interest. All reports that reported a 0-mortality rate were also removed. The final sample contains information on 47 unique acute care hospitals: 24 hospitals that undergo an LBO in 2010, and 23 not-for-profit hospitals.

The distribution of hospitals by state is shown in Figure 1. Ultimately, my balanced sample contains 611 hospital-years, or 611 observations of hospitals on the number of beds three mortality rates (acute myocardial infarction, heart failure, pneumonia) from 2005 to 2017, as reported in Table 1 above.

In addition to summary statistics, Table 1 demonstrates a preliminary difference-in-differences using the averages over pre- and post- LBO time frames. My goal is to use empirical analysis to estimate the effect and significance undergoing an LBO has on patient mortality relative to non-LBO acute care hospitals.

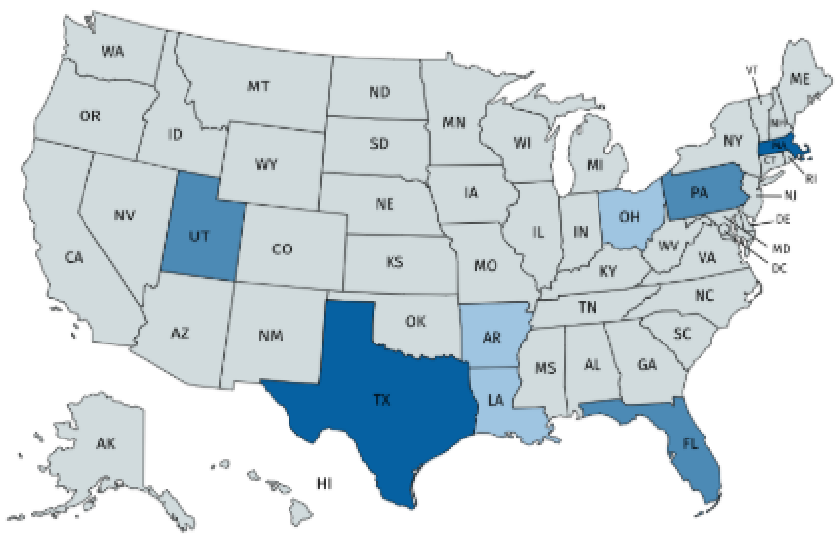

Fig. 1. Distribution of Sample Hospitals by State

Darker colors indicate the number of hospitals in the sample with the following ranges: 1-3, 4-10, 10+

IV. Effects of the Leveraged Buyout

A. Empirical Model Regression Methods

Our empirical model considers the effects of an LBO expansion and hospital size (number of beds) on hospital mortality. I estimated the effect of the various mortality rates through a series of linear fixed effects regression models:

Equation: Linear Fixed Effects Regression

$$Y_{ht} = \beta_{ht}X_{ht} + \eta_h + \lambda_t + \beta_{LBO}LBO_{ht} + \varepsilon_{it}$$

Y_{ht} represents a dependent variable of interest, which stands for a measure of mortality for hospital h at time t. X_{ht} represents the number of beds, as a control for hospital size. η_h contains hospital fixed-effects that are time-invariant and unique to each hospital. λ_m includes year fixed-effects for all reports made in the given year and are reported as a dummy variable. $\beta_{LBO}LBO_{ht}$ time-varying and binary treatment indicator (LBO_{ht}: 0=non-LBO, 1=LBO), which is dependent on the given year *(t)* and the hospital *(h)* and displays the impact of an LBO on the estimator of interest through the β_{LBO} coefficient value. ε_{it} is the error term and represents the residuals from the regression. By using a fixed effects regression, we can thereby treat my random variables as non-random, and hold constant average effects for individual hospitals through hospital dummies, as well as constant average year effects through year dummies. By doing so, I am able to significantly reduce the threat of omitted variable bias.

B. Results

The results of the regression, on hospital mortality metrics, can be found in Table 2 below. Holding for the fixed effects (hospital and report year), the linear fixed effects regression model estimates the impact of the effectors (number of beds and LBO status) on the estimator of interest (Y_{ht}).

Table 2. Balanced Panel Linear Fixed Effects Regression Model Results from 2005-2017

Estimator:	Regressors:		
Y_{ht}:	X_1: Number of Beds	X_2: LBO Status	R^2:
30-day Heart Failure Mortality Rate	-4.38E-05 (0.001089) [-0.04]	0.226 (0.1314) [1.721]**	0.9944
30-day Pneumonia Mortality Rate	-6.66E-04 (0.00158) [-0.421]	0.676 (0.191) [3.546]***	0.9932
30-day Heart Attack Mortality Rate	-2.50E-03 (0.001037) [-2.41]***	0.0457 (0.1297) [0.352]	0.9967

Results for the estimate on the LBO coefficient based on ordinary least squares regressions
** = Denotes Statistical Signicicance at 95% Confidence Interval
*** = Denotes Statistical Signicicance at 99% Confidence Interval
Standard errors reported in parenthesis
[T-statistic] reported on the bottom in brackets
n=1,882

Results from Table 2 indicate significant values that align with previous mixed findings on for-profit and not-for-profit differences in mortality rate. The effect of the binary regressor changing from 0 to 1 is the coefficient of the binary regressor on the mortality rate measured. For example, the effect of undergoing an LBO increases the 30-day heart failure mortality rate of a hospital by 0.226. Supporting previous research on overall mortality rates, the regression shows that undergoing an LBO has a positive and statistically significant effect on mortality rates for heart failure and pneumonia [T-value: 1.721**, T-value: 3.546***, respectively]. Results from the regression further show that undergoing an LBO raised 30-day pneumonia rates by 0.676. Interestingly, there was not a significant increase in mortality rate for acute myocardial infarction patients. This result is more in line with contemporary literature that argues there is little to no difference in healthcare quality for private for-profit and private, not-for-profit hospitals (Harvard, 2012, Cheney, 2016). The significance of undergoing an LBOs, all else equal, on mortality rates for heart failure and pneumonia, but not acute myocardial infarction patients suggests that more complicated mechanisms are at play in the overall mortality increase for hospitals that undergo an LBO.

C. Results: Clustered Robust Standard Error

While the fixed effects regression may drastically reduce the threat of omitted variable bias, some issues arise with the standard errors, as they are often drastically understated in the presence of serial correlation and heteroskedasticity (Betrand et al. 2003; Nickell 1981). The threat of heteroskedasticity is especially prevalent, given the relatively low sample size (n=49 for any given year). In order to account for both heteroskedasticity and serial correlation effects, I use a clustered robust standard error. The results are displayed in Table 3 below.

In doing so, the OLS estimator for the effect of an LBO remains unbiased and equal to the regression result displayed in Figure 2 but has increased the standard error of my estimate. The interpretation of the effects of an LBO on mortality remains the same; however, at a decreased significance level. Undergoing an LBO still has a significant and positive effect on 30-day heart failure and pneumonia mortality rates, at a 95% confidence level and a 99% confidence level, respectively.

Table 3. Balanced Panel Linear Fixed Effects Regression Model with Clustered Standard Errors Results from 2005-2017

Estimator:	Regressors:		
Y_{ht}:	X_1: Number of Beds	X_2: LBO Status	R^2:
30-day Heart Failure Mortality Rate	-4.38E-05 (0.001) [-0.04]	0.226 (0.136) [1.721]**	0.9944
30-day Pneumonia Mortality Rate	-6.66E-04 (0.002) [-0.421]	0.676 (0.197) [3.546]***	0.9932
30-day Heart Attack Mortality Rate	-2.50E-03 (0.001) [-2.41]***	0.0457 (0.135) [0.352]	0.9967

Results for the estimate on the LBO coefficient based on ordinary least squares regressions
** = Denotes Statistical Signicicance at 95% Confidence Interval
*** = Denotes Statistical Signicicance at 99% Confidence Interval
Standard errors reported in parenthesis clustered at the hospital level
[T-statistic] reported on the bottom in brackets
n=1,882

V. Robustness and Sensitivity Tests

A. Parallel Trend Analysis

The linear fixed effects regression model provides a useful tool when working with longitudinal data and examining the differences caused by a given treatment. The structure of the regression equation used in this paper is based on a Difference-in-differences (DiD) estimation model. This type of model allows for the control of specific factors for the hospital over the study period, while studying the differences in outcomes for the treatment, LBO status, on mortality rates.

One primary assumption of this model is "parallel trends." The parallel trends assumption states that the treatment group would have followed a similar trend to the control group had the treatment been absent. In this paper, had the LBO not occurred for hospitals, hospitals that would have undergone and LBO, and those that never did would have followed similar changes in mortality throughout the study duration. If this assumption fails, there is a concern that confounders are affecting the outcomes and the significance of the regression.

To examine this assumption, I constructed parallel trend graphs, using the mortality rates from the years pre-dating the LBO (2005-2010). The results can be observed in Figure 2, Figure 3, and Figure 4 below. The sample of hospitals from 2005-2010 were split into two groups: (1) hospitals that would eventually undergo an LBO and (2) hospitals that never underwent an LBO.

If parallel trends are observed between the two groups prior to the 2010 LBO date, this finding will strengthen the perceived effect of the LBO variable, and the overall findings from the regression.

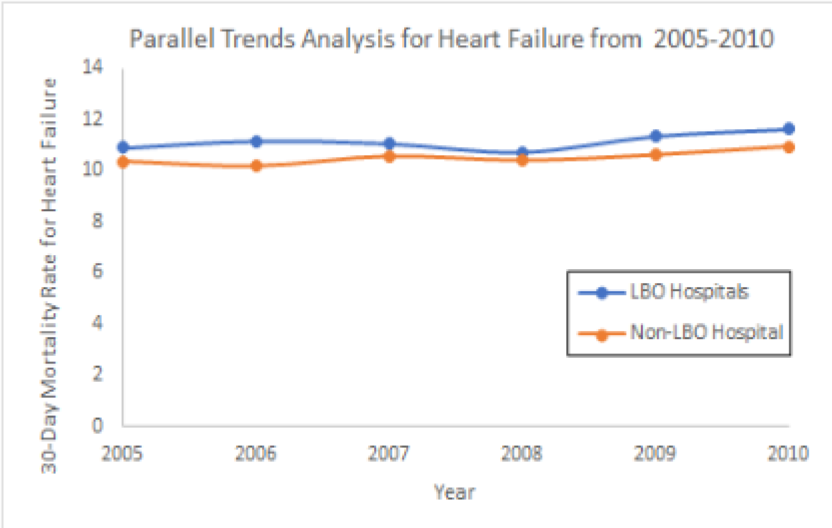

Fig 2. Graph displays trends of 30-Day risk adjusted mortality rates for heart failure patients from 2005-2010 for LBO and non-LBO hospitals.

Figure 2 displays lines that support our assumption of parallel trends. Both LBO and non-LBO hospitals show similar and comparable trends in their average 30-day mortality rates for heart failure. These results suggest limited effects from unobserved confounders on heart attack mortality, and further strengthen confidence in the significance of the OLS regression estimate. The establishment of a parallel trend in combination with a large magnitude in the difference of mortality rates for LBO and non-LBO hospitals [T-value: 1.721], it is fair to conclude that undergoing an LBO had a significant effect on the treatment hospitals relative to the control hospitals. Figure 2 thus supports the findings found in the regression.

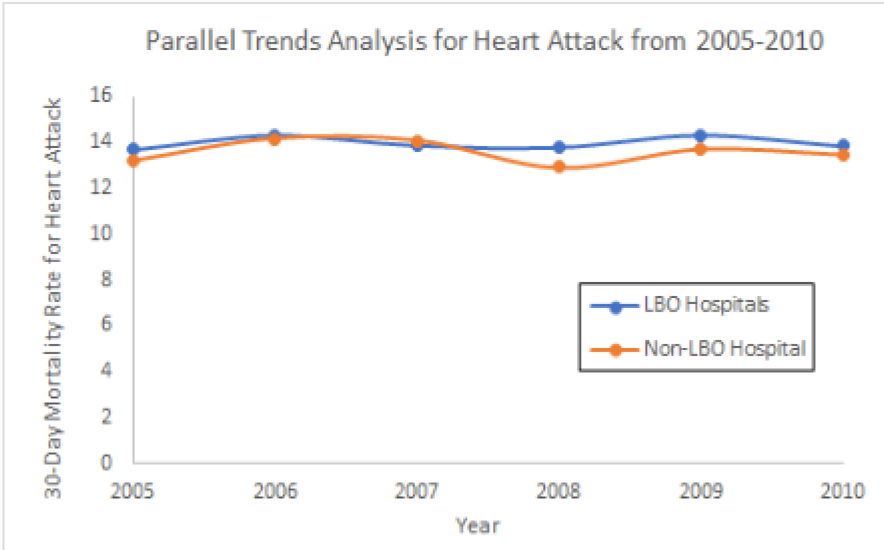

Fig 3. Graph displays trends of 30-Day risk adjusted mortality rates for heart attack patients from 2005-2010 for LBO and non-LBO hospitals.

Similar to Figure 2, Figure 3 displays comparable trends for mean 30-day risk-adjusted mortality rates for acute myocardial infarction (heart attack) patients. Figure 3, however, appears to deviate from the comparability in trend from year 2006 to 2007, with the mortality rate of LBO hospitals being too low, or the mortality rate of non-LBO hospitals being too high. Quantifying the difference between expected and realized mortality rate results in results in a 2.6% difference. Given that this difference is relatively small, we once again establish parallel trends in mortality rate and thereby induce further confidence in the fixed effects regression model used, and the results produced.

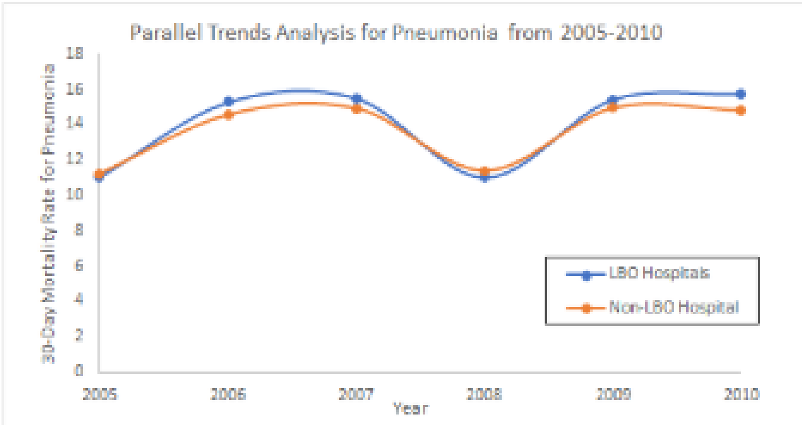

Fig 4. Graph displays trends of 30-Day risk adjusted mortality rates for pneumonia patients from 2005-2010 for LBO and non-LBO hospitals.

Similar to both Figure 2 and Figure 3, Figure 4 displays comparable trends for mean 30-day risk-adjusted mortality rates for pneumonia patients. While comparability in trends can be observed, the trend itself raises concerns as to the linearity of the model, and whether a linear model is most appropriate to use for analysis of the pneumonia mortality rate.

B. Linearity

I approach the issue of nonlinearity in the model illustrated in Figure 4 in two different ways: (1) through informational analysis and (2) linearity tests. One of the main issues that arise in modeling the observed wave-like pattern to a sin or cos regression model is the lack of periods. Figure 4 shows only 1.5 periods on the assumption that 2005 is the trough of the wave. Without having at least two distinct periods, it becomes difficult to model a sin or cos regression function to the data. To formalize these observations, I ran a Ramsey Regression Specification Error Test (RESET), and subsequently rejected the null hypothesis that there were polynomials of my regression model that could account for more variance in my dependent variable, mortality rate. Furthermore, the distribution of my residuals from my linear models was centered around 0 and had a normal distribution. These observations coupled with a high $\mathbf{R^2}$ value (0.99) gives confidence to the linearity of the fixed effects model and the robustness of the model.

C. Sensitivity to Variances in CMS Mortality Reports

One issue that arises in analyzing mortality rates is that the mortality rates reported through CMS are not consistent in measurement. CMS regularly updates their classification of diseases, in addition to including and excluding risk factors utilized in their risk-adjusted mortality rate estimations. CMS compiles their changes in an annually released measures updates and specification report. In particular, there were changes in 2016 to pneumonia measure specifications that allowed for a broader population of patients to be admitted as pneumonia patients. Inconsistent measurements may lead to skewed data analysis and results. By subjecting my model to an increase in the pneumonia mortality rate standard error for years 2015 and earlier, I estimate the potential effect of CMS' updated 2016 model release. A rate of 10% was chosen to account for a roughly 20% increase from 30 to 37 covariates from 2015 to 2016. This rate was weighted down to 10% to assume that the 2015 model was able to estimate at least 50% of pneumonia mortality. Artificially inflating the standard error for mortality rate estimates in 2015 and earlier was achieved through the addition of missense data. The previous findings illustrated in Table 2 remain significant for pneumonia but at a lower confidence level (90%). This sensitivity test remains largely arbitrary given the lack of correlation between 2016 and 2016 models, but nonetheless provides a first step in accounting for variances in CMS mortality reports.

VI. Discussion

This study suggests that, relative to acute care hospitals that do not undergo an LBO, hospitals that undergo an LBO face an increase in heart failure and pneumonia patient mortality rates. While a significant result was derived from a robust model, the study was somewhat limited in terms of access to data. While there were over 300 private equity deals in 2019, there were minimal private equity deals that involved hospitals, as much of the private equity industry was focused on the buyouts of pharmaceutical companies. Furthermore, high variations in the number of reports released made it challenging to account for such variations without the imposition of a balanced panel.

However, by balancing the panel, many observations were lost as a small cohort of hospitals were able to complete all 12 years of interest. The model then becomes a trade-off in terms of accruing enough information across the years and accruing information within the years. However, with additional robustness and sensitivity testing, the results of this study faced limited distortion from unobserved confounders, further supporting the positive relationship between LBO status and heart failure and pneumonia mortality rates.

Taken at face value, it may seem that the high debt nature and strict obligations to shareholders by private equity LBOs have created adverse increases in inpatient mortality rates. However, it depends, in part, on how for-profit hospitals fare against not-for-profit hospital mortality rates, of which the literature is divided on (Devereaux et al. 2002, (Harvard, 2012, Cheney, 2016).

In the circumstance that mortality rates are comparable between for-profit hospitals and not-for-profit hospitals, our findings would suggest that the increased mortality rates from a private equity LBO is a novel deviation from the typical for-profit hospital takeover. The most obvious difference then seems to be the larger amount of debt that is being used to finance the healthcare deal; this implies that high levels of debt repayment on relatively short timeframes may lead to management pressure to cut costs that decrease healthcare quality and subsequently increases in patient mortality.

However, if we side with the argument that mortality rates are higher in for-profit hospitals than not-for-profit hospitals, our findings would then emphasize similarities between typical private for-profit takeovers and private equity LBOs. This would imply that the usage of high debt has little impact on patient mortality rates and suggest similarities in asset management styles as a driver for increasing patient mortality rates. However, the usage of high levels of debt may still play a significant role in influencing adverse patient outcomes if adverse patient outcomes via monopolistic effects are accounted for in a typical private for-profit takeover.

Future studies may investigate quantifying the amount of debt used and see how increases in debt to equity ratios affect healthcare outcomes for hospital LBOs. Possible future directions may also involve analysis of private equity culture and its influence on management decisions that affect healthcare product quality.

It is important to note that the private equity's usage of LBOs relies heavily on the borrowing rate. With so few large troughs in the interest rate trend, my results and the results of other literature findings are limited most by the lack of data available for study.

However, researchers must continue longitudinal studies comparing hospital mortality rates in LBO hospitals versus non-LBO hospitals. The more years of data, the more conclusive the research can determine the long-term impacts private equity LBOs on patient mortality rates. As private equity firms increase their investment in the healthcare sector, it is imperative that researchers inform policymakers, healthcare providers, and patients alike, of the costs and benefits such ownership changes bring to the healthcare system.

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