

## Peer Review File

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### Reviewer A

**Comment 1:** This is an interesting paper. It is generally well written with good presentation of the context and conceptual background.

**Reply 1:** Thank you!

**Comment 2:** The data appear appropriate for answering the questions. Perhaps you could make some mention of data quality and completeness? How did you handle records with missing data?

**Reply 2:** Since our study has a longitudinal design that spans over 17 years, all hospitals without complete data, **with respect to the dependent variable**, throughout the study period were excluded from the study (n=85). The AHA data and AHRF data are the mostly used data for studies of US hospitals and county level data, respectively. The LAUS has the complete unemployment rate data at the county level.

### Changes in the text:

The AHA data are the mostly used data for studies of US hospitals and the AHRF data are the mostly used data with respect to county-level variables. The LAUS has the complete unemployment rate data at the county level. All these three data sets are publicly available. (page 9)

Fourth, hospitals without complete data, with respect to the dependent variable, throughout the study period were excluded (n= 85). (page 10)

**Comment 2:** The model is appropriate and the included variables appear justified.

**Reply 2:** Thank you!

**Comment 3:** For presenting the results, I would prefer to see confidence intervals rather than P values. If you have to use P values, I would prefer exact values (unless < 0.001) rather than threshold cutoffs.

**Reply 3:** We agree with Reviewer A. Now, the manuscript has the exact p-values (unless <0.001) and 95% confidence intervals of the variables described in the “Abstract” and “Results” section and we included confidence intervals and exact p-values (unless <0.001) in the Tables.

## Changes in the text:

**Results:** Our key findings suggested that privatization was associated with a decrease in Saidin index ( $\beta = -0.74$ ;  $p = 0.016$ ; 95%CI [-1.43; -1.38]). For-profit privatization was associated with a greater decrease in Saidin index ( $\beta = -1.29$ ;  $p = 0.024$ ; 95% CI [-2.41; -0.17]), compared with an insignificant decrease for not-for-profit privatization ( $\beta = -0.56$ ;  $p = 0.106$ ; 95% CI [-1.25; 0.12]). (Abstract)

The results of the fixed-effects linear regressions are summarized in Table 3. After controlling for organizational and environmental factors, privatization was associated with a decrease in Saidin index ( $\beta = -0.74$ ;  $p = 0.016$ ; 95% CI [-1.34; -1.38]); hypothesis 1 was supported. Hypothesis 2 was partially supported; privatization to FP was associated with a greater decrease in Saidin index ( $\beta = -1.29$ ,  $p = 0.024$ ; 95% CI [-2.41; -0.17]) compared with a non-significant decrease for privatization to NFP ( $\beta = -0.56$ ;  $p = 0.106$ ; 95% CI [-1.25; 0.12]). However, the results from the `lincom` command showed that the difference in the levels of high-technology services for FP and NFP privatizations was not statistically significant (coefficient = 0.73;  $p = 0.252$ ; 95% CI [-0.52; 1.99]).

The results of the sensitivity analysis using count index as the dependent variable were similar to the results using Saidin index. Privatization was associated with a significant decrease in count index ( $\beta = -1.03$ ;  $p = 0.007$ ; 95% CI [-1.78; -0.285]), but the effect size was greater with count index than Saidin index. In the same vein, FP privatization was associated with a greater decrease in count index ( $\beta = -1.72$ ;  $p = 0.015$ ; 95% CI [-3.11; -0.34]), compared with a smaller and marginally significant decrease for NFP privatization ( $\beta = -0.80$ ;  $p = 0.061$ ; 95% CI [-1.64; 0.04]). However, the results from the `lincom` command indicated that that the difference in the levels of high-technology services for FP and NFP privatizations was not statistically significant (coefficient = 0.92;  $p = 0.245$ ; 95% CI [-0.63; 2.47]) (Table not shown)

With respect to the control variables, the results of privatization from public to private status as well as privatizations from public to NFP and from public to FP status (Table 3) were quite similar. Thus, we report the results of privatizations from public to NFP and from public to FP status. Several organizational variables were positively associated with Saidin index: hospital beds ( $\beta = 0.01$ ;  $p \leq 0.001$ ; 95% CI [0.01; 0.02]), occupancy rate ( $\beta = 4.76$ ;  $p \leq 0.001$ ; 95% CI [3.68; 5.84]), percent Medicare inpatient days ( $\beta = 2.94$ ;  $p \leq 0.001$ ; 95% CI [3.68; 5.84]), and contract management ( $\beta = 0.51$ ;  $p = 0.026$ ; 95% CI [0.06; 0.96]). The variables outpatient mix ( $\beta = -4.00$ ;  $p \leq 0.001$ ; 95% CI [-5.79; -2.21]) and multihospital system membership ( $\beta = -1.38$ ;  $p \leq 0.001$ ; 95% CI [-1.73; -1.02]) were negatively associated with Saidin index.

With respect to market variables, per capita income ( $\beta=0.11$ ;  $p\leq.001$ ; 95% CI [0.08; 0.15]), unemployment rate ( $\beta=0.33$ ;  $p\leq.001$ ; 95% CI [0.25; 0.40]) were positively associated with Saidin index. The variables number of physicians per 1,000 population ( $\beta=-0.55$ ;  $p\leq.001$ ; 95% CI [-0.86; -0.24]), yearly change in unemployment rate ( $\beta=-1.47$ ;  $p\leq.001$ ; 95% CI [-2.13; -0.82]), excess capacity ( $\beta=-0.008$ ;  $p=0.006$ ; 95% CI [-0.01; -0.02]), and HHI ( $\beta=-3.27$ ;  $p\leq.001$ ; 95% CI [-4.64; -1.90]) were negatively associated with Saidin index. (pages 14-15)

**Comment 4:** For hypothesis 2, you appear to be basing your conclusion on the difference in magnitude and significance of the two coefficients. This is not appropriate. You then mention the joint test almost as an afterthought, although this is what you should be using to draw your conclusion.

Even better --- present the contrast that relates to the hypothesis. This is the difference between the coefficient for NFP and the coefficient for FP, together with its confidence interval (and maybe P value). In Stata, a simple `lincom` command will give you this.

**Reply 4:** We agree with Reviewer A. We used the “`lincom`” command instead of the “joint test”. The Methods and Results sections were revised accordingly. The results from the `lincom` command including the coefficient, p-value, and 95% confidence interval are included in the Results section.

### Changes in the text:

Our dependent variables Saidin index and count index (for sensitivity analysis) were both approximately normal, based on skewness and kurtosis.<sup>48-50</sup> None of our independent variables had multicollinearity issues. To test Hypothesis 2, the “`lincom`” command in STATA was used after the regression analysis on the impact of privatization to either NFP or FP status on high-technology services level. “`Lincom`” stands for linear combination, this command asks STATA to compute the difference between the beta coefficients of NP and NFP privatizations and assess whether that difference is statistically significant. . SAS version 9.2 was used for data cleaning and STATA version 14 was used for data analysis. (page 13)

The results of the fixed-effects linear regressions are summarized in Table 3. After controlling for organizational and environmental factors, privatization was associated with a decrease in Saidin index ( $\beta = -0.74$ ;  $p = 0.016$ ; 95% CI [-1.34; -1.38]); hypothesis 1 was supported. Hypothesis 2 was partially supported; privatization to FP was associated with a greater decrease in Saidin index ( $\beta = -1.29$ ,  $p = 0.024$ ; 95% CI [-2.41; -0.17]) compared with a non-significant decrease for privatization to NFP ( $\beta = -0.56$ ;  $p=0.106$ ; 95% CI [-1.25; 0.12]). However, the

results from the `lincom` command showed that the difference in the levels of high-technology services for FP and NFP privatizations was not statistically significant (coefficient = 0.73;  $p = 0.252$ ; 95% CI [-0.52; 1.99]). (page 14).

The results of the sensitivity analysis using count index as the dependent variable were similar to the results using Saidin index. Privatization was associated with a significant decrease in count index ( $\beta = -1.03$ ;  $p = 0.007$ ; 95% CI [-1.78; -0.285]), but the effect size was greater with count index than Saidin index. In the same vein, FP privatization was associated with a greater decrease in count index ( $\beta = -1.72$ ;  $p = 0.015$ ; 95% CI [-3.11; -0.34]), compared with a smaller and marginally significant decrease for NFP privatization ( $\beta = -0.80$ ;  $p = 0.061$ ; 95% CI [-1.64; 0.04]). However, the results from the `lincom` command indicated that the difference in the levels of high-technology services for FP and NFP privatizations was not statistically significant (coefficient = 0.92;  $p = 0.245$ ; 95% CI [-0.63; 2.47]) (Table not shown). (page 14).

**Comment 5:** The discussion is reasonable. As the discussion and conclusion suggest, the important question is not whether privatisation reduces services at an individual hospital, but whether it reduces availability of services to the population. I hope the authors will find some way to address this more important question in future work.

**Reply 5:** We agree with Reviewer. It is a good idea to pursue this study even further to assess the availability of the services to assess the impact of privatization on the availability of services that meet the health care needs of the population.

### **Changes in the text:**

Fourth, we were not able to assess the availability of high-technology services at the population level, after privatization. Future studies are needed to examine the impact of public hospital privatization on high-technology services offered to the population. (Limitations - page 18).

### **Reviewer B**

This is a very well written manuscript, focusing on an important and valid topic.

Some minor suggestions/comments:

**Comment 1:** Abstract/results: add quantitative data on number of hospitals from your sample that underwent privatization, to NFP and FP respectively



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**Reply1:** We agree with Reviewer B. The number of hospitals that underwent privatization in general and privatization to NFP and FP are now included in the Abstract.

**Changes in the text:**

Among the 492 public hospitals in our sample, 104 hospitals (21%) privatized. Among the privatized hospitals, 75 hospitals (72%) converted to NFP status and 29 hospitals (28%) converted to FP status. (Abstract)

**Comment 2:** Methods: add justification for the choice of the year's period 2007-2013; the study publication year would be 2020, so the data till only 2013 seem obsolete?

**Reply 2:** We agree with Reviewer B that data till only 2013 seem obsolete. However, there have been two major changes in the US health care system after 2013. The full implementation of the Affordable Care Act (ACA), signed into law 2010, was in 2014. Some provisions of the ACA to improve access and quality of care while enhancing efficiency (as seen in Hospital value-based purchasing programs) may affect the provision of high-technology health care services. In the same vein, the Medicare Access and CHIP Reauthorization Act (MACRA), signed into law in 2015 and implemented in 2017, which involves some fundamental changes in physician reimbursement from treating Medicare patients, may also affect the provision of high-technology services. Also, adding more years to our study period of 17 years will lead to additional attrition of hospitals and result in smaller sample size. As we add more years to the data, the number of hospitals that have missing data with respect the dependent variable, increases and they need to be dropped from the sample.

**Changes in the Text:**

Data after 2013 were not included in our study years due to the major changes in the US healthcare system after 2013. The full implementation of the Affordable Care Act (ACA), signed into law 2010, was in 2014. Some provisions of the ACA to improve access and quality of care while enhancing efficiency (as seen in Hospital value-based purchasing programs) may affect the provision of high-technology health care services. In the same vein, the Medicare Access and CHIP Reauthorization Act (MACRA), signed into law in 2015 and implemented in 2017, which involves some fundamental changes in physician reimbursement from treating Medicare patients may also affect the provision of high-technology services. Also, adding more years to our study period of 17 years will lead to additional attrition of hospitals and result in smaller sample size. As we add more years to the data, the number of hospitals that have missing data with, respect the dependent variable, increases and they need to be dropped from the sample. (Page 9).

**Comment 3:** Discussion: in whole discussion section might be extended, to provide a more comprehensive comparison to the international literature.

**Reply 3:** We agree with Reviewer B. We came across several articles on privatization of public hospitals in several countries Europe, Latin America, Asia, and the Middle East, especially Saudi Arabia. However, we could not find any empirical studies on the impact of privatization on the provision of high-tech services that are similar to our study to grant comparison. We thought one study on two hospitals in Saudi Arabia, titled “The Impact of Healthcare Privatization on Access to Surgical Care: Cholecystectomy as a Model”, could be compared with our study. Unfortunately, this study was misleading as it did not assess the change in the provision of cholecystectomy service after privatization.

**Changes in the text:**

Finally, we were not able to compare our findings with the findings of comparable empirical studies using data from other countries. Since privatization of public hospitals is a global phenomenon, empirical studies assessing its impact on the provision of high-tech services in other countries are greatly encouraged. (Limitations, page 18).

**Comment 4:** Either in the Conclusion or Discussion - provide clear implications of the study, optimally divided into those for researchers and policy-makers

**Reply 4:** We agree with Reviewer B. We included a paragraph for “Managerial implications” and a paragraph for “Policy implications” in the Discussion section.

**Changes in the text:**

Managerial implications:

While a reduction in high-technology services provision, after privatization, may be a good strategy to reduce expenditures and improve the financial outlook of the hospital, a thorough assessment of the choice of high-technology services to discontinue is important. Such choice should be based on the needs of the population and the cost-effectiveness of the technologies to ensure that patients have adequate access to the needed services without causing financial stress to hospitals. Some technologies may be highly advanced and costly, and yet the marginal improvements in health care process and outcomes may be minimal. Conversely, privatized hospitals may assess the availability of high-technology services to the community and decide to close those services that are already provided by other facilities to avoid service duplication. This may contribute to overall efficiency at the community level.<sup>52</sup> Also, involving physicians in decisions to cut high-technology services is important since

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they are the key providers. Outsourcing high-technology services to other nearby facilities may also be a better alternative to closing those services. (page 17)

Policy implications:

City, county, or state governments that plan to privatize their public hospitals may need to conduct some preliminary studies on provision of high-tech services, after privatization, to ensure continuity of needed services, without imposing a financial burden to the hospital. Community health needs assessment coupled with cost-benefit analysis and comparative effectiveness studies may help all parties involved in deciding which high-technology services to discontinue. A tight monitoring of public hospital privatization is important to ensure continuity of needed high-technology services. (page 18)