

Article

Not peer-reviewed version

---

# Maryland's All-Payer Model and Hospital Financial Stability: A Comparative Analysis with Massachusetts

---

Kola Adegoke \*

Posted Date: 24 November 2025

doi: 10.20944/preprints202510.1901.v2

Keywords: Maryland All-Payer Model; global hospital budgets; hospital financial stability; hospital payment reform; difference-in-differences; inpatient prices



Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a [Creative Commons CC BY 4.0 license](https://creativecommons.org/licenses/by/4.0/), which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Article

# Maryland's All-Payer Model and Hospital Financial Stability: A Comparative Analysis with Massachusetts

Short title: Maryland All-Payer Model vs Massachusetts Hospital Finances

Kola Adegoke <sup>1,2</sup>

<sup>1</sup> Department of Health & Biomedical Sciences, College of Health Professions, University of Texas Rio Grande Valley, 1201 W. University Drive, Edinburg, TX 78539, USA; kola.adegoke01@utrgv.edu

<sup>2</sup> School of Health Sciences and Practice, New York Medical College, 40 Sunshine Cottage Road, Valhalla, NY 10595, USA

## Abstract

**Background:** Maryland's all-payment model (APM) replaces fee-for-service hospital payments with regulated global budgets to stabilize finances and restrain costs. Evidence of how this model affects hospital margins and prices relative to similar fee-for-service states remains limited. **Objective:** To compare trends in hospital financial margins and inpatient prices in Maryland and Massachusetts from 2017 to 2024. We hypothesized that Maryland hospitals would exhibit more stable margins and lower overall price levels than Massachusetts hospitals, under regulated global budgets. **Methods:** We used hospital-level panel data from the RAND Hospital Cost Report Information System for fiscal years 2017–2024, restricted to acute-care hospitals in Maryland and Massachusetts. The outcomes were total margin and log inpatient revenue per discharge (proxy for price per discharge). A difference-in-differences fixed-effects model with hospital and year fixed effects and standard errors clustered at the hospital level compared changes before and after 2019, when Maryland's Total Cost of Care phase began (md×post2019). **Results:** At baseline, Maryland hospitals had slightly higher margins and lower prices than Massachusetts hospitals (mean total margin 0.019 vs -0.073; mean log price per discharge 9.27 vs 9.49). After 2019, there was no statistically significant difference in the total margins between Maryland and Massachusetts ( $\beta = -0.001$ , SE = 0.003,  $p = 0.76$ ). In contrast, log inpatient revenue per discharge grew modestly faster in Maryland, from a lower starting level ( $\beta = 0.072$ , SE = 0.025,  $p = 0.004$ ), although Maryland prices remained below Massachusetts levels by 2024. **Conclusions:** Maryland's all-payer global budget system appears compatible with stable hospital margins and a lower overall price level relative to a benchmark fee-for-service state, but it was not associated with slower post-2019 price growth. Global budgets may support financial stability and moderate price levels, yet they should not be assumed to produce stronger price restraints than well-regulated fee-for-service benchmarks.

**Keywords:** Maryland All-Payer Model; global hospital budgets; hospital financial stability; hospital payment reform; difference-in-differences; inpatient prices

---

## Plain Language Summary

Hospitals in the United States are usually paid under fee-for-service, where they earn more when they deliver more care. This can increase costs and destabilize hospital finances, especially during shocks, such as the COVID-19 pandemic. Maryland is different: the state uses "global budgets," which gives hospitals a fixed annual revenue target from all payers.

In this study, we compared hospitals in Maryland with those in Massachusetts, another highly insured state that still relies on fee-for-service. Using financial data from 2017 to 2024, we tracked hospital margins (profits as a share of revenue) and the average revenue per inpatient stay.

We found that on average, Maryland hospitals had slightly higher margins and lower revenue per discharge than Massachusetts hospitals. However, when we used a statistical approach to look for a clear break in trends after Maryland's 2019 Total Cost of Care expansion, the estimated "before-and-after" policy effect was small and not statistically precise.

Overall, the results suggest that Maryland's global budget system is associated with stable finances and relatively restrained prices rather than large jumps in profit. For policymakers, the main message is that regulated, prospective payments can support predictable hospital revenue, but they should not be expected to produce dramatic short-term gains on their own.

## 1. Introduction

Rising hospital costs and revenue volatility continue to threaten the financial sustainability of U.S. hospitals, especially under fee-for-service (FFS) payments, which reward volume rather than value and can encourage fragmented care and cost growth.

Maryland's all-payment model (APM) is the most comprehensive state-level effort for addressing these issues. Under a waiver from the Centers for Medicare & Medicaid Services (CMS), Maryland replaced traditional FFS inpatient payments with all-payer global hospital budgets regulated by the Health Services Cost Review Commission (HSCRC), capping annual revenue growth and tying payments to quality and population health goals.<sup>1–3</sup> The model was strengthened in 2019 with the expansion of the Total Cost of Care (TCOC), which broadened accountability for spending and care coordination beyond the inpatient setting.<sup>3,4</sup>

Early evaluations of Maryland's APM have reported slower Medicare spending growth, reduced avoidable utilization, and evidence that global budgets can support cost containment without an apparent collapse in hospital finances.<sup>2,3,5</sup> Using RAND's Hospital Cost Report Information System (HCRIS) data from 2017–2024, which provides standardized hospital-level financial metrics across states and enables a comparative analysis of Maryland and Massachusetts over time, this study addresses questions that are increasingly relevant as CMS and states explore expanding global budget approaches through newer initiatives such as AHEAD.<sup>2,5–7</sup>

Massachusetts offers a valuable comparison. Both Maryland and Massachusetts are high-income countries with advanced hospital systems and high insurance coverage.<sup>8,9</sup> However, Massachusetts largely retains FFS payments and emphasizes transparency and cost-growth benchmarks, rather than regulated global budgets.<sup>9,10</sup> The contrast between Maryland's rate-regulated, all-payer system and Massachusetts's benchmark-driven, market-based approach creates a natural setting for examining whether global budgeting is associated with distinct trajectories in hospital margins and prices.

At the same time, the COVID-19 pandemic exposed the vulnerability of volume-based hospital revenue to sharp demand shocks, raising concerns about financial distress and resilience under different payment structures.<sup>11,12</sup>

The hospital-level data from the RAND Hospital Cost Report Information System (HCRIS) for 2017–2024 in this study compares Maryland and Massachusetts on two key indicators of financial performance: total margin and log inpatient revenue per discharge (a proxy for price per discharge). We use a fixed-effects difference-in-differences framework with hospital and year fixed effects to assess whether trends in margins and prices diverged across the two states after the 2019 TCOC expansion.

## 2. Research Questions

1. **Margins:** Did total hospital margins in Maryland change differently from those in Massachusetts after the 2019 TCOC expansion? (RQ1)

2. **Prices:** Did log-inpatient revenue per discharge in Maryland follow a different post-2019 growth trajectory than that in Massachusetts? (RQ2)

3. **Stability around COVID-19 (exploratory):** Did Maryland's global budgets appear to dampen or amplify marginal volatility during the COVID-19 period (2020–2022) relative to Massachusetts? (RQ3)

### Hypotheses

- **H1 (financial stability):** Maryland hospitals under the all-payment model will exhibit more stable total margins over time than hospitals in Massachusetts, particularly after 2019 and during COVID-19.
- **H2 (price growth):** Log inpatient revenue per discharge will grow more slowly for Maryland hospitals than for Massachusetts hospitals after 2019, reflecting a stronger price restraint under global budgets.

### 3. Literature Review

Payment models shape both hospital cost growth and financial resilience. In Massachusetts, early global payment contracts were associated with slower spending growth and preserved quality of care, suggesting that prospective budgets could restrain costs without obvious deterioration in outcomes. In Maryland, analyses of the All-Payer Model's early years found that global hospital budgets reduced Medicare expenditures and utilization growth while maintaining access and key quality indicators.<sup>3</sup> Qualitative work with hospital leaders has emphasized that global budgets can stabilize revenue, but may introduce operational and administrative challenges.<sup>4</sup>

Comparative policy reports from the Commonwealth Fund and CMS describe Maryland's all-payer hospital rate-setting and global budgeting framework as unusually comprehensive relative to other state reforms, and highlight its potential as a reference model for cost control and accountability.<sup>5,7</sup> At the same time, multi-state reviews underline that state oversight structures, market concentration, and baseline prices all condition how well such models perform.<sup>5</sup>

The COVID-19 pandemic has exposed the vulnerability of volume-based hospital revenue. Studies of hospital finances during the pandemic documented substantial revenue shocks and heightened distress in fee-for-service environments, particularly in safety-net and high-Medicaid hospitals. These findings are consistent with the idea that global budgets may function as partial shock absorbers when the demand fluctuates sharply. However, they stop short of directly comparing regulated and non-regulated states.

Previous evaluations of Maryland's all-payment model have mainly examined Medicare spending and utilization, without comparing Maryland's hospital finances to those in another reform-minded state.<sup>3–5,11,12</sup> To our knowledge, this study contributes by providing the first cross-state panel comparison of Maryland and Massachusetts using all-payer hospital financial outcomes from 2017 to 2024, enabling us to determine whether global budgets lead to different trajectories in margins and prices compared to a benchmark fee-for-service system.

Despite extensive descriptive work on Maryland and global budgets, quantitative comparisons of Maryland's financial performance with that of another reform-oriented state remain rare. Using the RAND Hospital Cost Report Information System data set<sup>6</sup> and a quasi-experimental panel design, this study addresses this gap by asking whether Maryland's regulated all-payer system produced more stable margins and slower growth in inpatient revenue per discharge than Massachusetts's benchmark-based, fee-for-service-oriented approach.

### 4. Methods

#### 4.1. Study Design and Analytic Framework

This study used a difference-in-differences (DiD) design to compare hospitals' financial performance in Maryland and Massachusetts from 2017 to 2024. Maryland hospitals operate under the all-payment model with global hospital budgets, whereas Massachusetts hospitals mainly pay on a fee-for-service basis under a cost-growth benchmark approach. Policy contrast and similar state-level characteristics support a quasi-experimental comparison.

We estimated within-hospital changes in outcomes before and after 2019, when Maryland's Total Cost of Care model was implemented, and compared the changes between Maryland and Massachusetts. Hospital fixed effects controlled for time-invariant hospital characteristics, and year fixed effects captured common shocks, including national macroeconomic and pandemic-related influences, consistent with the best-practice DiD guidance.<sup>13–15</sup>

#### 4.2. Data Source and Sample

We used hospital-level data from the RAND Hospital Cost Report Information System (HCRIS) for fiscal years 2017–2024.<sup>6</sup> Annual Medicare cost reports were merged to construct an unbalanced panel of acute care hospitals in Maryland and Massachusetts, identified by Medicare provider number and report year. We then restricted the dataset to acute hospitals and calculated the total margin and inpatient revenue per discharge, as described below.

Observations were aggregated to the hospital-year level and deduplicated by Medicare provider number (provider\_num) and the report year. The panel was unbalanced, reflecting hospital entry, exit, and occasional missing-cost reports.

#### 4.3. Measures

##### 4.3.1. Dependent Variables

- **Total margin:** net income divided by total revenue (RAND variable total\_margin), used as a summary indicator of hospitals' financial performance.
- **Log price per discharge:** Natural logarithm of inpatient revenue per discharge, defined as total inpatient revenue divided by all inpatient discharges (l\_price\_per\_discharge). This measure serves as a proxy for the average price or revenue per case.

##### 4.3.2. Key Independent Variables

- **Maryland indicator (md):** equals 1 for hospitals in Maryland and 0 for hospitals in Massachusetts.
- **Post-policy period (post-2019):** equals 1 for 2019–2024 and 0 for 2017–2018.
- **Treatment effect (md × post2019):** The DiD interaction term capturing differential changes in Maryland relative to Massachusetts after 2019.

For descriptive analyses and exploratory checks, we used an indicator for the COVID-19 period (coefficient = 1 for 2020–2022; 0 otherwise).

##### Covariates and fixed effects

The main regression models included:

- Hospital fixed effects ( $\alpha_i$ ) to account for time-invariant hospital characteristics.
- Year fixed effects ( $\lambda_t$ ; i.report\_year) to capture national shocks and secular trends.

Ownership and other time-varying characteristics were examined descriptively, but were not included in the primary fixed-effects models because of data limitations and missingness.

Table 1 summarizes the mean total margin and mean log price per discharge by state during the study period.

#### 4.4. Statistical Analysis

We estimated hospital-level fixed effects regressions with robust standard errors clustered by provider\_num. The general model was:

$$Y_{it} = \alpha_i + \lambda_t + \beta (md_i \times post2019_t) + \varepsilon_{it}$$

where  $Y_{it}$  is either the total margin or log price per discharge for hospital  $i$  in year  $t$ ;  $\alpha_i$  are hospital fixed effects,  $\lambda_t$  are year fixed effects, and  $\beta$  is the DiD estimate of Maryland's post-2019 differential change relative to Massachusetts.

The two primary specifications were:

##### 1. Total margin model:

$$total\_margin_{it} = \alpha_i + \lambda_t + \beta_M (md_i \times post2019_t) + \varepsilon_{it}$$

##### 2. Price model:

$$\ln(price\_per\_discharge_{it}) = \alpha_i + \lambda_t + \beta_P (md_i \times post2019_t) + \varepsilon_{it}$$

The coefficients  $\beta_M$  and  $\beta_P$  are interpreted as the average post-2019 differences in margins and log prices per discharge for Maryland hospitals relative to Massachusetts hospitals, controlling for any common time trends.

##### Stata Implementation

All analyses were conducted using Stata 18 software (StataCorp LLC, College Station, TX, USA). The panel declared the following:

```
xtset provider_num report_year
```

The main DiD models were estimated with:

```
xtreg l_price_per_discharge md##post2019 i.report_year, fe cluster(provider_num)
```

```
xtreg total_margin md##post2019 i.report_year, fe cluster(provider_num)
```

Coefficients of the interaction term 1. md#1.post2019 and the constants were exported using an `esttab` to create the regression table (Table 2). Descriptive state-level means by year were generated using `collapse`, and state-by-year trends were plotted using two-way line graphs for margins and log price per discharge.

#### 4.5. Sensitivity Analyses and Diagnostics

Several sensitivity checks were explored:

- A placebo DiD specification using a "fake" post period beginning in 2018, to test for spurious treatment effects.
- Exploratory models interacting MD with a COVID-19 period indicator (2020–2022) to examine whether differential effects were concentrated during the pandemic period.
- Cross-sectional balance checks in 2021, comparing case mix, occupancy, and payer mix between Maryland and Massachusetts using t-tests and ordinary least squares regressions.

These exercises were used to assess the plausibility of the parallel trends assumption and to identify major imbalances in line with recommendations for DiD design in health services research.<sup>13–15</sup>

Model diagnostics confirmed that the fixed effects estimators converged with non-singular variance-covariance matrices and meaningful within-hospital variations in outcomes over time. The suppression of overall F statistics in some outputs reflected Stata's use of clustered variance estimators rather than model failure.

## 5. Results

### 5.1. Sample Characteristics

The analytical dataset contained **1,275 hospital-year observations** from **Maryland (n = 458)** and **Massachusetts (n = 817)** between 2017 and 2024. The panel was unbalanced, with one to eight observations per hospital. Hospitals were identified by Medicare provider number and followed over time as an unbalanced panel, using hospital-year records.

### 5.2. Descriptive Comparisons

Table 1 summarizes the mean total margins and log inpatient revenue per discharge by state. Over the entire period, Maryland hospitals had slightly positive average total margins (0.019), whereas Massachusetts hospitals had modestly negative margins (−0.073), consistent with near-break-even performance in the all-payer system versus a small deficit in the benchmark-based system.

The mean **log price per discharge** was **lower in Maryland (9.27)** than in Massachusetts (9.49), suggesting higher average revenue per inpatient stay in Massachusetts during the study period. These differences in levels suggest that Maryland's long-standing rate regulation was associated with a lower overall price level.

State-level trends (Figures 1 and 2) showed that Maryland's total margins remained relatively stable from 2017 to 2024, while Massachusetts hospitals exhibited more year-to-year variability, including dips around the COVID-19 period. For prices, both states displayed gradual increases over time, but Maryland remained below Massachusetts for most years.

**Table 1. Mean Financial Outcomes by State, 2017–2024.**

State	Total margin	Log price per discharge
MA	−0.0727	9.4866

MD	0.0189	9.2713
----	--------	--------

Notes: Values represent hospital year means from 2017 to 2024. The total margin is defined as net income divided by total revenue. The log price per discharge is the natural logarithm of total inpatient revenue divided by the total inpatient discharge.

### 5.3. Difference-in-Differences Regression

Table 2 reports fixed-effects difference-in-differences estimates from hospital-level regressions with hospital and year fixed effects and hospital-clustered standard errors.

In the **total margin** model, the Maryland  $\times$  post-2019 interaction was small and statistically insignificant ( $\beta = -0.001$ ,  $SE = 0.003$ ,  $p = 0.76$ ), indicating no detectable change in Maryland's margins relative to Massachusetts. The within-hospital  $R^2$  was 0.007, indicating that most of the variation in margins was cross-sectional rather than temporal. These results suggest that Maryland's transition to the Total Cost of Care phase **did not materially alter margins relative to Massachusetts** and that global budgets maintained financial performance close to breakeven without boosting profitability.

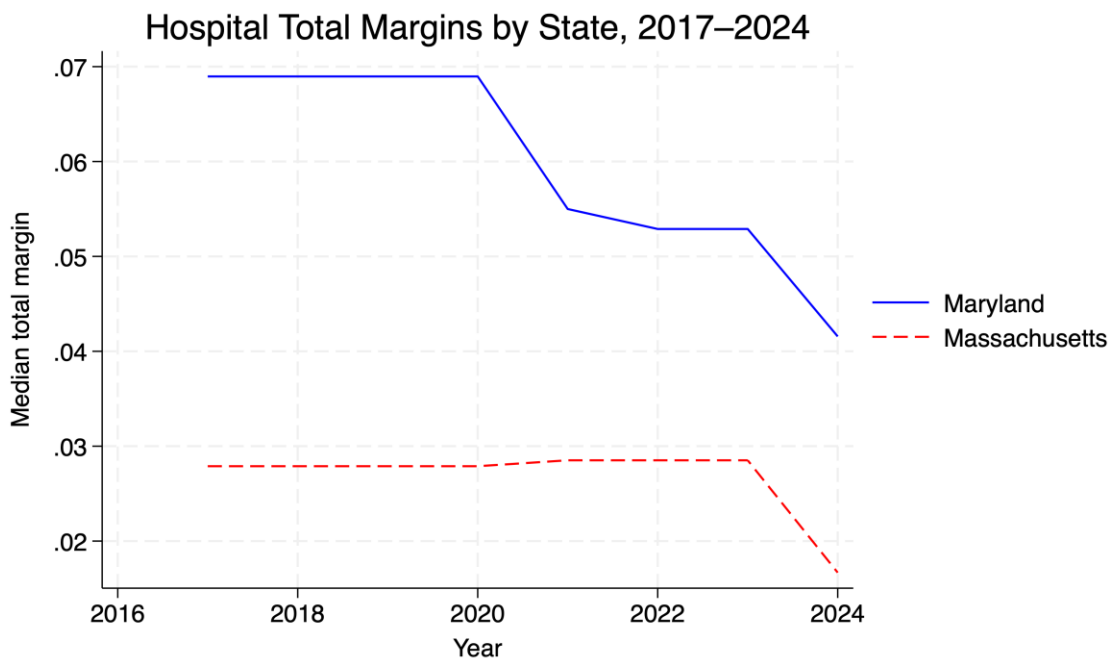
In the log price per discharge model, the Maryland  $\times$  post-2019 interaction was positive and statistically significant ( $\beta = 0.072$ ,  $SE = 0.025$ ,  $p = 0.004$ ), implying an approximately 7–8% higher growth in inpatient revenue per discharge for Maryland hospitals relative to Massachusetts hospitals after 2019, from a lower initial price level. For-profit ownership was associated with substantially higher prices ( $\beta \approx 0.543$ ;  $p < 0.01$ ), whereas government hospitals had lower prices ( $\beta \approx -0.327$ ;  $p < 0.05$ ). Ownership explained more of the variation in revenue intensity than the policy interaction term, but Maryland's overall level remained below Massachusetts across the period.

**Table 2. Fixed-Effects Regression Results: Maryland vs Massachusetts, 2017–2024.**

	(1) Total margin	(2) Log price per discharge
Maryland $\times$ post-2019	-0.005	-0.006
	(0.004)	(0.006)
For-profit	0.003	0.543***
	(0.005)	(0.025)
Government	-0.001	-0.327**
	(0.006)	(0.129)
Constant	-0.093***	9.448***
	(0.004)	(0.004)
Observations	649	662
$R^2$ (within)	0.007	0.0068
Fixed effects	Hospital, year	Hospital, year
SEs	Clustered by hospital	Clustered by hospital

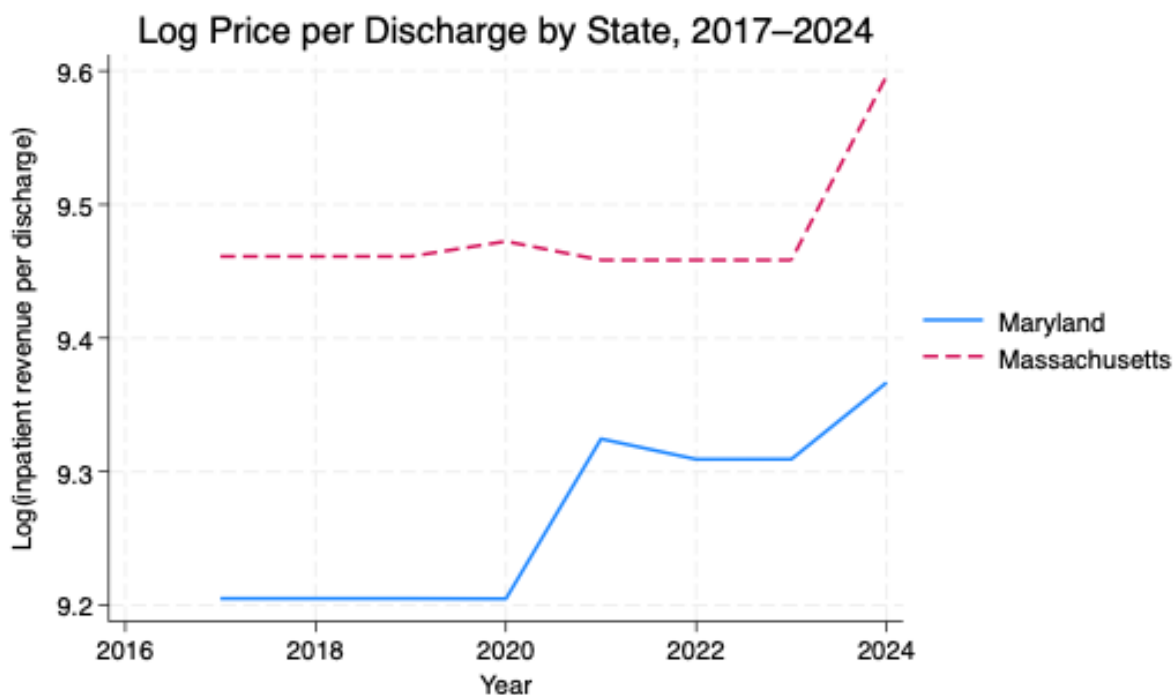
Notes: Robust standard errors clustered at the hospital level are in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . The Maryland  $\times$  post-2019 coefficient represents the difference-in-differences estimate comparing changes in Maryland hospitals after 2019 with the contemporaneous changes in Massachusetts hospitals. Massachusetts and nonprofit hospitals served as the reference categories. Year indicators are included in the models but omitted from the table for brevity.

Figure 1 (margins): Figure 1 plots *median* total margins by state and year, rather than means, to reduce the influence of extreme values in a small subset of hospitals.



**Figure 1. Hospital Total Margin by State, 2017–2024.** Note: Median hospital total margins for Maryland and Massachusetts. In 2024, the medians were shown to reduce the influence of a small number of extreme outliers. Maryland margins remained slightly higher and more stable than those in Massachusetts during the study period.

Figure 2 (prices): Figure 2 shows mean log inpatient revenue per discharge by state and year, illustrating that prices remain consistently lower for Maryland hospitals than for Massachusetts hospitals over 2017–2024.



**Figure 2. Log Inpatient Revenue per Discharge by State, 2017–2024.** Note: State-level means of log(total inpatient revenue per discharge) by report year. Maryland and Massachusetts series plotted using hospital-year data from RAND HCRIS.

Mean log inpatient revenue per discharge for hospitals in Maryland and Massachusetts by report year 2017–2024. The log price per discharge is defined as  $\ln(\text{total inpatient revenue}/\text{total inpatient discharge})$ . Maryland maintained a lower overall price level than Massachusetts throughout the period, with no significant post-2019 divergence between the states.

#### 5.4. Interpretation

Overall, the results show that Post-2019, price *growth* was modestly faster in Maryland than in Massachusetts, although Maryland remained below Massachusetts in absolute price levels, and that the 2019 Total Cost of Care expansion did not generate a significant differential shift in margins or prices between the two states. The small and imprecise DID coefficients are more consistent with stabilization than with either a sharp improvement or deterioration in Maryland's relative position. Ownership differences, rather than state policy alone, account for much of the variation in revenue intensity.

Margins (RQ1 / H1). Maryland hospitals had slightly higher total margins and experienced somewhat smoother trends than Massachusetts hospitals. However, the Maryland $\times$ post-2019 DiD coefficient for the total margin was small and imprecise, showing no statistically significant post-2019 divergence in the margins between the two states.

Prices (RQ2 / H2). Maryland hospitals maintained lower overall log inpatient revenue per discharge than Massachusetts hospitals from 2017 to 2024. However, the positive, statistically significant Maryland $\times$ post-2019 interaction for log price per discharge suggests a slightly faster price growth in Maryland after 2019, contrary to the expectation of slower growth under H2.

COVID-19 stability (RQ3, exploratory). Descriptive plots indicated that Maryland's margins were somewhat less volatile during the COVID-19 period than those of Massachusetts. Nonetheless, regression estimates do not reveal sharp or precisely estimated COVID-specific divergence.

#### 5.5. Robustness

Several robustness checks supported our main findings. Fixed-effects models estimated without ownership controls produced similarly small and imprecise Maryland  $\times$  post-2019 coefficients for both the total margin and log price per discharge. Random-effects specifications yielded comparable point estimates, suggesting that unobserved between-hospital heterogeneity did not influence the results. Alternative functional forms for the price outcome (e.g., using levels rather than logs) did not materially change the magnitude or statistical significance of the estimated treatment effects. Taken together, these checks reinforce the interpretation that Maryland's global budget system maintained financial stability without generating considerable divergence from that of Massachusetts.

## 6. Discussion

This study compared hospital financial performance in Maryland and Massachusetts from 2017 to 2024 using hospital-level cost report data. Maryland operates under an all-payer global budget system, whereas Massachusetts relies on fee-for-service payments with cost growth benchmarks. At the hospital level, Maryland hospitals had slightly higher average total margins and consistently lower log inpatient revenue per discharge than Massachusetts hospitals did.

These findings extend earlier work on Maryland's model, which emphasized Medicare savings and selected quality outcomes,<sup>3–5</sup> by showing that, across all payers, Maryland hospitals maintained slightly higher margins and lower revenue per discharge than Massachusetts hospitals, but without a significant post-2019 divergence. In contrast to prior analyses of COVID-era financial risk, this study uses a cross-state panel design to compare a regulated global budget system with a benchmark-regulated fee-for-service system over 2017–2024.<sup>11,12</sup>

Our findings offer mixed support for these hypotheses. Consistent with H1 and RQ1, Maryland hospitals under global budgets showed slightly higher and more stable total margins than Massachusetts hospitals; however, the Maryland $\times$ post-2019 difference-in-differences estimate for margins was small and statistically insignificant, indicating no clear post-2019 divergence. For H2 and RQ2, we confirmed that Maryland maintained a lower overall price level, but post-2019, price growth was modestly faster in Maryland than in Massachusetts, contrary to the expectation of slower

price growth under global budgets. Exploratory analyses related to RQ3 suggest some indication of reduced margin volatility in Maryland during the COVID-19 period, although these effects were not precisely estimated.

These results are broadly consistent with prior evaluations of Maryland's model, which showed slower Medicare spending growth and improvements in selected quality measures, without significant gains in hospital profitability.<sup>3–5</sup> Qualitative work has emphasized that global budgets can stabilize revenue and support planning while introducing operational complexity.<sup>2,4</sup> Our findings complement the literature by showing that across all payers, Maryland hospitals under global budgets appear to maintain near-breakeven margins and lower unit revenue levels, rather than generating substantial windfalls relative to a benchmark state.

The lower price levels in Maryland are consistent with broader analyses of global budgeting and rate regulation as cost control tools.<sup>2,5,10</sup> At the same time, minor, imprecise margin effects and somewhat faster post-2019 price growth in Maryland caution against attributing large incremental financial gains solely to the Total Cost of Care expansion. The pattern is more consistent with a system that anchors prices and stabilizes revenue over time, relative to a market-based comparator, rather than one that produces sharp breaks in trends.

The COVID-19 pandemic is an important stress test. Prior work has shown that fee-for-service hospitals were highly exposed to volume shocks and elective procedure cancellations during the pandemic with measurable financial distress in some markets.<sup>11,12</sup> In our data, Massachusetts showed somewhat greater volatility in margins than Maryland, but the regression estimates did not reveal a dramatic or statistically distinct COVID-specific divergence. This is consistent with the idea that global budgets may partially cushion shocks, although the limited variation and sample size restrict our ability to quantify this effect.

This study had several limitations. First, the analysis relies on RAND-processed HCRIS cost report data, which, while cleaned and standardized, still reflect hospital-reported financial information and may vary according to accounting practice and reporting completeness.<sup>6</sup> Second, the study window (2017–2024) captures the mature phase of Maryland's all-payment model and the early Total Cost of Care expansion but omits the initial transition years (2014–2016), when short-term financial effects may have been more pronounced.<sup>1,3</sup> Third, the design compares only two states; even with hospital- and year-fixed effects, unmeasured differences in market structure, case mix, payer composition, and regulatory environment may lead to residual confounding.<sup>13–15</sup> Fourth, the primary outcomes, total margin and log inpatient revenue per discharge, are hospital-level financial indicators that do not directly capture patient-level utilization, quality, or equity outcomes.<sup>3,10</sup> Fifth, within-hospital variation over time is modest, contributing to low within R<sup>2</sup> values and wide confidence intervals for the Maryland×post-2019 coefficient, which limits power to detect small effects. Finally, exploratory placebo and event-study specifications were unstable and sensitive to modeling choices; therefore, we did not use them for formal inference and cautiously interpreted dynamic effects.<sup>13–15</sup>

Despite these limitations, our findings have practical implications for payment reforms. For policymakers considering global budgets or the AHEAD model, the Maryland–Massachusetts comparison suggests that statewide rate regulation can maintain hospital financial stability and maintain relatively low unit revenue levels without generating large post-policy profit increases.<sup>16,17</sup> This profile may be appealing when the policy goal is to support access and predictability while restraining cost growth, rather than to engineer large short-term savings or margin shifts.

In summary, Maryland's all-payer global budget system is associated with slightly higher margins and lower prices than that of Massachusetts. However, the post-2019 difference-in-differences effects are modest, with no clear margin divergence and somewhat faster price growth from a lower baseline. The evidence points toward stability and moderate cost control rather than dramatic financial effects. Future work using richer covariates, additional comparison states, and more flexible event study designs could further clarify how global budgets shape hospital finances under varying market conditions.

### 6.1. Policy Implications

This study suggests that Maryland's all-payer global budget system can maintain hospital financial stability without producing large post-2019 shifts in margins or prices relative to the benchmark state. In terms of levels, Maryland hospitals show slightly higher average total margins and lower log inpatient revenue per discharge than Massachusetts hospitals; however, the difference-in-differences estimates for the Maryland  $\times$  post-2019 term are small and statistically imprecise. Taken together, this pattern is consistent with a policy that anchors prices and stabilizes revenue, rather than one that generates sharp financial gains.

These findings align with the rationale behind Maryland's waiver and the broader move toward prospective, population-based payment models such as the CMS all-payment model, total cost of care model, and emerging AHEAD initiative.<sup>2,3,5,7,16,17</sup> Global budgets appear capable of providing predictable revenue streams while avoiding substantial margin inflation, which may be attractive in markets with fragmented payer mixes, rural exposure, or high baseline cost growth.<sup>2,3,5</sup> At the same time, Massachusetts's experience with benchmark regulation and largely fee-for-service payments shows that non-rate-setting approaches can also moderate spending in highly insured, high-capacity systems.<sup>10</sup>

Therefore, the comparison supports a "toolbox" view of payment reform, rather than a single template. Regulated all-payer systems may be most useful when policymakers seek strong control over hospital prices and revenue volatility, while benchmark-based approaches may suffice in settings with robust competition and strong purchaser oversight.<sup>2,5,9</sup> Payment design will likely need to be tailored to local economic and institutional conditions rather than applied uniformly across states.

## 6.2. Future Research

Future studies should extend this analysis in three ways. First, expanding the comparison set beyond Massachusetts to include states with different regulatory and market structures would help clarify whether Maryland's experience is unique or representative of a broader class of payment reform. Second, linking hospital financial data to quality, utilization, and patient outcome measures would allow for a more complete assessment of whether global budgets support value, not only fiscal stability.<sup>2,3,10</sup>

Third, applying more flexible quasi-experimental designs, such as modern event-study estimators and synthetic control approaches, could strengthen the tests of the parallel-trends assumption and better capture heterogeneous effects across hospitals. As CMS moves forward with the AHEAD model and related demonstrations, mixed-methods studies that combine quantitative analyses with interviews with hospital finance leaders and regulators are important for understanding how local governance, risk tolerance, and management strategies shape success under global budgeting.<sup>2,4,7,17</sup>

## 7. Conclusions

In this comparative analysis of Maryland and Massachusetts hospitals from 2017 to 2024, Maryland's all-payer global budget system is associated with slightly higher average total margins and lower log inpatient revenue per discharge than Massachusetts's benchmark-regulated fee-for-service system. However, the key Maryland  $\times$  post-2019 difference-in-differences term is small and statistically insignificant for both the total margin and price, indicating no firm evidence of a discrete break in trends after the Total Cost of Care expansion.

These findings support a cautious interpretation: Maryland's global budgets appear to maintain hospital financial stability and constrain price levels in relative terms; however, the analysis does not show large incremental gains in profitability or additional price suppression after 2019. This is consistent with prior work that describes global budgets as mechanisms for revenue predictability and moderate cost control, rather than as instruments for rapid margin expansion.<sup>2-5,7,10</sup> In an era of repeated shocks—including the COVID-19 pandemic, which exposed the vulnerability of volume-dependent hospitals<sup>11,12</sup>—such stability may itself be an important policy achievement.

For policymakers, Maryland's experience suggests that prospective regulated payment systems can be a viable strategy for sustaining hospital finances while containing costs, especially in markets

where fee-for-service incentives and payer fragmentation pose challenges. At the same time, modest effect sizes and design limitations underline the need for further work before generalizing Maryland's model or assuming large financial gains from global budgets alone.

**Author Contributions:** Kola Adegoke conceived the study, conducted the data analysis, interpreted the results, and drafted the manuscript. The authors approved the final version of the manuscript and were accountable for all aspects of the work.

**Data Citation:** White C. *RAND Hospital Data: Web-Based Tool*. TL-303. RAND Corporation; 2024. Available from: <https://www.rand.org/pubs/tools/TL303.html>.

**Data Availability Statement:** The data used in this study are derived from the RAND Hospital Data (2017–2024), and RAND retains all rights and intellectual property to the data. A trimmed analytic dataset containing de-identified and aggregated variables, along with the Stata code used for data cleaning and modeling, is available in the Open Science Framework (OSF) repository: Project URL: <https://osf.io/vj7et> DOI: <https://doi.org/10.17605/OSF.IO/6FHZA>.

**Ethical Compliance:** All analyses used publicly available, de-identified, aggregate data from the RAND Hospital Data and state policy databases. In accordance with U.S. regulations and institutional policy, this study does not constitute human subject research as defined by 45 CFR 46 and was therefore exempt from institutional review board (IRB) review and informed consent requirements. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Replication materials, including Stata code and processed RAND Hospital datasets used to generate the tables and figures, are archived at the Open Science Framework (OSF; DOI: <https://doi.org/10.17605/OSF.IO/6FHZA>, project URL: <https://osf.io/vj7et>).

**Ethical approval:** Not required. This study used publicly available, de-identified data and did not meet the regulatory definition of human subject research.

**Competing Interests:** The author declares no competing interests.

**Funding:** This research received no specific grants from any funding agency in the public, commercial, or not-for-profit sector.

## References

1. Rajkumar R, Patel A, Murphy K, et al. Maryland's all-payer approach to delivery-system reform. *N Engl J Med*. 2014;370(6):493-495. doi: 10.1056/NEJMp1314868
2. Sharfstein JM, Gerovich S, Moriarty E, Chin D. An Emerging Approach to Payment Reform: All-Payer Global Budgets for Large Safety-Net Hospital Systems. New York, NY: The Commonwealth Fund; August 2017. Accessed November 19, 2025. Available at: [https://www.chhs.ca.gov/wp-content/uploads/2021/10/An-Emerging-Approach-to-Payment-Reform\\_-All-Payer-Global-Budgets-for-Large-Safety-Net-Hospital-Systems.pdf](https://www.chhs.ca.gov/wp-content/uploads/2021/10/An-Emerging-Approach-to-Payment-Reform_-All-Payer-Global-Budgets-for-Large-Safety-Net-Hospital-Systems.pdf)
3. Beil H, Haber SG, Giuriceo K, et al. Maryland's global hospital budgets: impacts on Medicare cost and utilization for the first 3 years. *Med Care*. 2019;57(6):417-424. DOI: 10.1097/MLR.0000000000001118
4. Kilaru AS, Crider CR, Chiang J, Fassas E, Sapra KJ. Health care leaders' perspectives on the Maryland All-Payer Model. *JAMA Health Forum*. 2022;3(2):e214920. DOI: 10.1001/jamahealthforum.2021.4920
5. Commonwealth Fund. Hospital Global Budgeting: Lessons From Maryland and Selected Nations. New York: The Commonwealth Fund, June 2024. Accessed November 19, 2025. Available at: <https://www.commonwealthfund.org/publications/fund-reports/2024/jun/hospital-global-budgeting-lessons-maryland-selected-nations>
6. RAND Corporation. Hospital Cost Report Information System (HCRIS) Data Files. Santa Monica, CA: RAND Corporation; 2025. Accessed November 19, 2025. Available at: <https://www.rand.org/pubs/tools/TL303.html>

7. Centers for Medicare & Medicaid Services. Maryland All-Payer Model. Accessed October 31, 2025. Available at: <https://www.cms.gov/priorities/innovation/innovation-models/maryland-all-payer-model>
8. StatsAmerica. State Per Capita Personal Income, 2024. Accessed October 31, 2025. Available at: [https://www.statsamerica.org/sip/rank\\_list.aspx?rank\\_label=pcpi1](https://www.statsamerica.org/sip/rank_list.aspx?rank_label=pcpi1)
9. California Health Care Foundation. Commissioning Change: Four States' Advisory Boards for Health Care Cost Containment. Oakland, CA: California Health Care Foundation; 2020. Accessed November 19, 2025. Available at: <https://www.chcf.org/publications/commissioning-change-four-states-advisory-boards-health-care-cost-containment>
10. Song Z, Rose S, Safran DG, Landon BE, Day MP, Chernew ME. Changes in health care spending and quality 4 years into global payment. *N Engl J Med*. 2014;371(18):1704-1714. DOI: 10.1056/NEJMsa1404026
11. Orlando AW, Field RI. Measuring the COVID-19 financial threat to hospital markets. *Inquiry*. 2021;58:doi:10.1177/00469580211059985
12. Neupane M, Warner S, Mancera A, et al. Association between hospital type and resilience during COVID-19 caseload stress. *Ann Intern Med*. 2024. DOI: 10.7326/M24-0869
13. Sun L, Abraham S. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *J Econometrics*. 2021;225(2):175-99. <https://doi.org/10.1016/j.jeconom.2020.09.006>
14. Wing C, Simon K, Bello-Gomez RA. Designing difference-in-difference studies: best practices for public health policy research. *Annu Rev Public Health*. 2018;39:453-469. <https://doi.org/10.1146/annurev-publhealth-040617-013507>
15. Zeldow B, Hatfield LA. Confounding and regression adjustment in difference-in-differences studies. *Health Serv Res*. 2021;56(5):932-41. <https://doi.org/10.1111/1475-6773.13666>
16. Health Services Cost Review Commission. Total Cost of Care (TCOC) Model. Accessed November 19, 2025. Available at: <https://hsrc.maryland.gov/Pages/tcocmodel.aspx>
17. Health Services Cost Review Commission. AHEAD Model. Accessed November 19, 2025. Available at: <https://hsrc.maryland.gov/Pages/ahead-model.aspx>

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.