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Healthcare Spending and Efficiency in the United States: Case Study of the Midwest

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Abstract

Healthcare and related matters are of paramount importance for any nation in general and any household in particular. It has been axiomatic for decades that the US spends a great deal regarding healthcare and, on balance, achieves less compared with peer advanced economies. This could suggest at the very least the existence of some forms of inefficiencies across the healthcare system. The search for empirical evidence on this matter is the focus of this paper, which zeroes in on the 12 Midwestern states of the US. With a yearly unbalanced panel covering the 1997-2020 period, VAR-based analyses appear to corroborate the narrative of an inefficient healthcare system in the Midwest when considering three medical outcomes, namely, cancer mortality, heart disease mortality, and infant mortality. It is found as well that the scope of inefficiencies differs based upon the medical outcome considered, with the most severe case noted for infant mortality.

Key Words: *Healthcare, Efficiency/Inefficiency, United States, Midwest*

1. Introduction

Healthcare and related matters are of paramount importance for any nation in general and any household in particular. For a nation, vast amounts of resources are earmarked yearly to establish, develop, and maintain a functioning healthcare system destined to ensure the wellness of its population and improve the overall quality of life. For a household, healthcare along with access to it is a central concern. It is typically addressed by means of healthcare insurance acquired through an employer, individually, or a combination thereof. This central concern does not abate for about 10% of the population, as of 2023, that lacks or struggles to get health insurance. On the other hand, the leading cause of bankruptcies in the United States (US) is medical debt, which accounts for roughly 66.5% of them. It's also noteworthy that at least 72% of those bankruptcy filings are made by individuals who do carry health insurance according to a reputable study published through *Health Affairs* and funded by the Robert Wood Johnson Foundation and Harvard University (Himmelstein et al., 2005), among others.[1]

[1] Full list of funding institutions for this project: the Robert Wood Johnson Foundation, the Ford Foundation, Harvard Law School, and New York University Law School.

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Based upon the latest figures from 2022, healthcare spending in the US represented around 18% of gross domestic product (GDP). In other words, about $4.6 trillion was devoted to healthcare spending in that year alone, or about $12,900 per person. That amount is sheerly astronomical and by far the largest across all nations. To bring further perspectives, the world second highest-spending country on healthcare in the same year was Germany at $667 billion; that is, $8,010 per person. Yet, life expectancy and many medical care outcomes for the average citizen in Germany are as good as those in the US, if not better. Similar patterns are noted in other advanced nations, such as New Zealand, Norway, Australia, among others. The fact speaks for itself, as it cannot be further overlooked: The US overspends and on balance achieves less compared with peers. This connotes the existence of some marked forms of inefficiencies in the US healthcare system.

The post-COVID economic environment across the nation is characterized by a pair of factors. First, states as well as the Federal government have been incurring ballooning deficits and debts. Second, households have been experiencing growing financial hardships driven, among others, by healthcare costs. Against this backdrop, it becomes pressing to explore the interplay between healthcare spending and efficiency. The potential implications of this exploration highlight the relevance of this paper. The research objective is to empirically assess the impacts of healthcare spending on selected medical outcomes in the 12 Midwestern states of the US.[2] Medical outcomes are captured through three key metrics: (i) cancer mortality, (ii) heart disease mortality, and (iii) infant mortality.

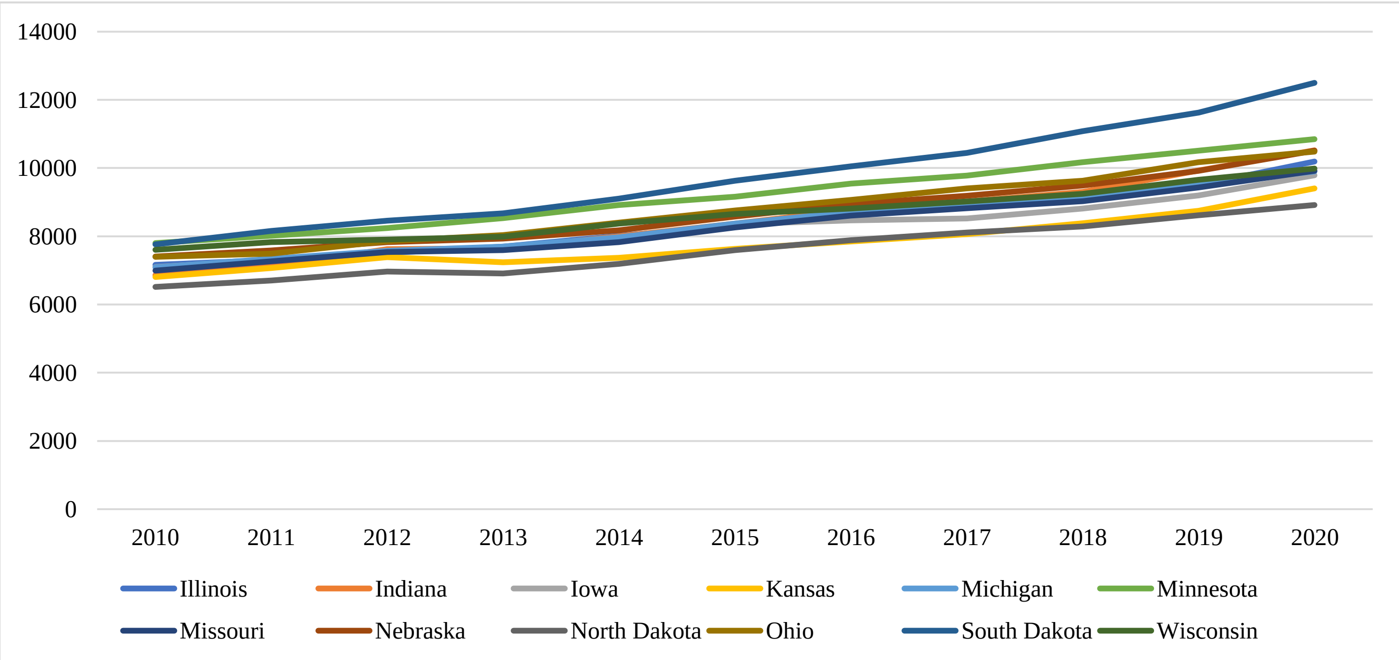
Moving forward, the paper is organized around four axes. The second axis reviews the literature followed by the presentation of methodology and data in third. The fourth axis discusses results and policy implications, whereas a conclusion is laid out in fifth.

2. Literature Review

It is educative to start by surveying some empirical facts about the current state of healthcare. In a widely disseminated seminal report about wasteful spending on healthcare, the Organisation of Economic Co-operation and Development (OECD) revealed that over 9% of gross domestic product (GDP) was spent on healthcare across its member states (OECD, 2017). The report underscored that 6% of healthcare expenditure was the result of fraud and errors, whereas more than 10% of hospital spending went toward correcting preventable medical mistakes or infections. In the United States particularly, Bailey (2022) went to great lengths to shed light on some interesting findings from an investigation conducted through *Health Affairs.*[3] It exposed that clinical waste ─ including failures of care delivery, failures of care coordination, and overtreatment ─ amounted to a staggering 15.7 percent of all healthcare spending.

According to compelling data from the Kaiser Family Foundation (KFF),[4] some information can be underlined regarding Midwestern states and their healthcare outlays. It appears that healthcare spending per capita has experienced a notable upward trend since 2010, as shown in Exhibit 1. Case in point, from 2010 to 2020, Exhibit 2 reveals that South Dakota registered the highest spending with an average of $9,770 per capita, while North Dakota scored the lowest spending at $7,609 on average per capita. Furthermore, Exhibit 3 shows that the growth rates in per capita spendings were 4.9% and 3.2%, respectively, for these two states. For any state in general, such growth rates exert considerable pressure on their finances, as their abilities to raise funds are more limited as compared to the federal government's.

Exhibit 1 – Health spending per capita in Midwestern States and the United States, 2010-2020



Source: KFF, Kaiser Family Foundation.

[2] Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

[3] It is a reputable peer-reviewed journal, established in 1981, covering health policy research.

[4] Founded in 1948, it is a leading non-profit authority and independent institution on healthcare data and policies in the US.

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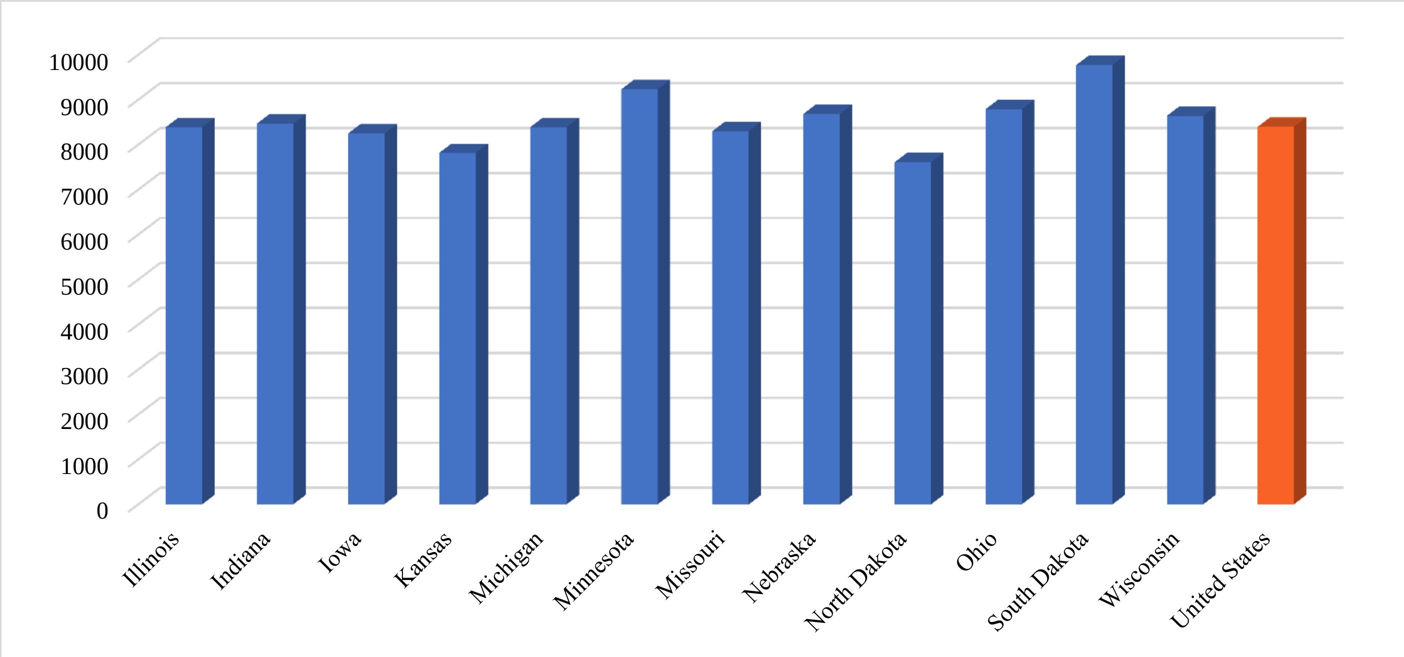
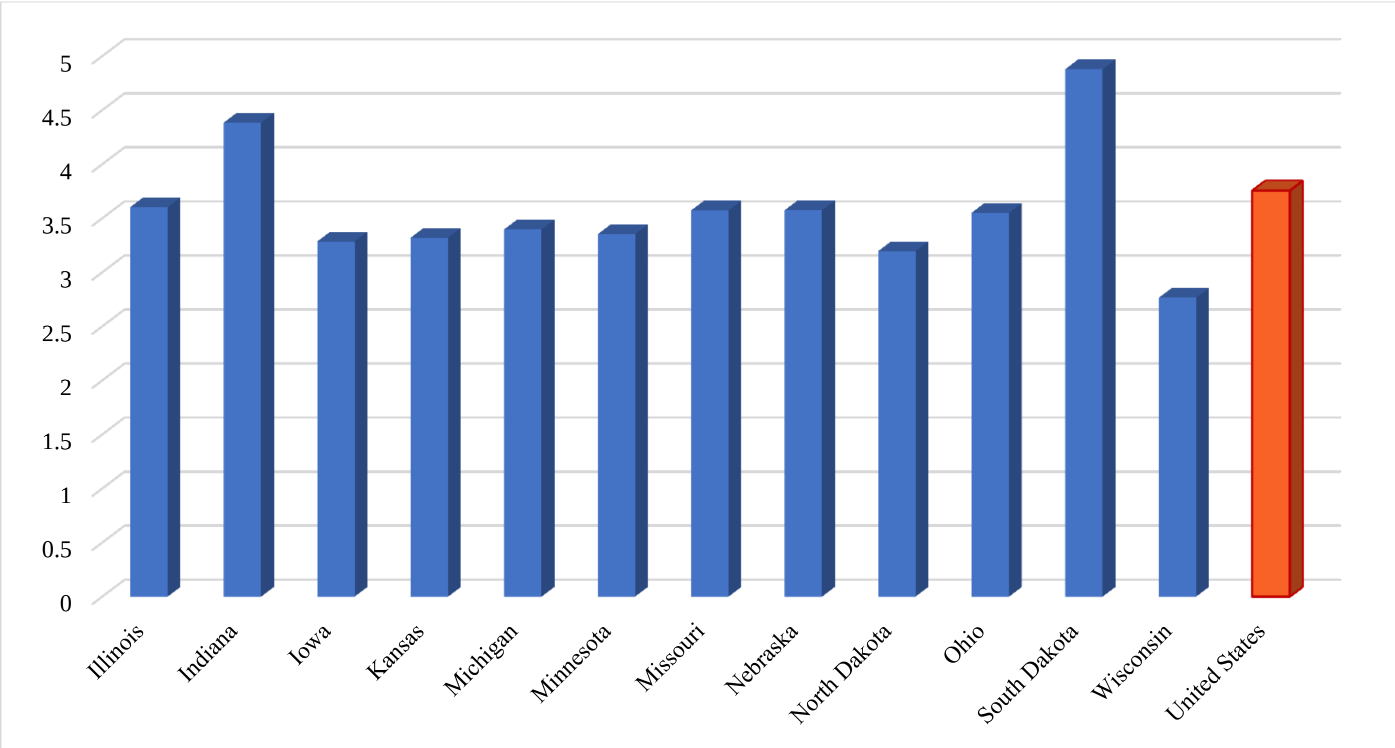
Exhibit 2 – Average per capita spending in Midwestern States, 2010-2020



Source: KFF, Kaiser Family Foundation.

Exhibit 3 – Average growth rates of per capita spending in Midwestern States, 2010-2020



Source: KFF, Kaiser Family Foundation.

From an academic perspective, the literature signals that many scholars have investigated the link between healthcare spending and efficiency, which has drawn interest for decades. It is important to understand this link because of the financial implications for governments as well as households. Three noticeable works can be succinctly discussed in that regard. For instance, Zarulli et al. (2021) completed an extensive 140-country study where they discovered that education level, unemployment and income distribution of income played critical roles in explaining differences in efficiency. Furthermore, M. G. Brandão et al. (2023) focused on the US to examine cost-effectiveness of spending using both theory and clinical practices. One element to take away was the suggestion that the current healthcare system be transitioned toward a value-based system. Lastly, Olivares-Tirado and Zanga (2023) combed through the literature to identify evidence on the sources of wasteful healthcare spending in an attempt to foster informed public policies, implement more cost-effective clinical practices, and thus generate more efficiency and equity in health systems.

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3. Methodology and data

3.1. Methodology

The estimation process in the study is anchored in the vector autoregression (VAR) approach, which is ubiquitous in empirical investigations throughout the literature.[5] It is used to build a baseline model to gain insight into the interplay between medical outcomes and its potential determinants. Specifically, a VAR of order k, VAR(k), is considered:

$\Pi_{t-k} = \alpha + \delta_1\Pi_{t-1} + \delta_2\Pi_{t-2} + \ldots + \delta_k\Pi_{t-k} + \varphi_t$ (1),

where Π_t, α, and φ_t are all (q x 1) vectors; $\delta_1, \delta_2, \ldots, \delta_k$ are (q x q) vectors. $E(\varphi_t) = 0$, and $E(\varphi_t\varphi'_{t-k}) = 0$; with the latter indicating no correlation across time. Also, $E(\varphi_t\varphi'_t) = \Sigma$ represents the contemporaneous (q x q) covariance matrix. After careful review of available data for Midwestern states, this analysis structurally considers q = 5, accounting for medical outcome,[6] spending, spending squared, state output, and price level of medical services. Specifically, the "spending squared" factor is meant to capture the marginal effect of a dollar spent in the region on healthcare. It is a metric that can provide an additional layer of understanding how efficiently spendings are impacting medical outcomes.

Using the baseline model above described, two key steps are followed to derive a set of empirical results that gives a comprehensive understanding of the impacts of outlays on medical outcomes. Understanding these impacts remains the cornerstone of this research work, for they will lay out evidence regarding the existence and scope of efficiency, or inefficiency, across the region. In the first step, equation (1) is run with q = 4, including the first four variables in the list aforementioned (Variant I). To check for the consistency along with the robustness of findings, a second step is considered by running variant II, which adds the price level of medical services to reach q = 5 for the system. This variant helps ascertain whether controlling for fluctuations in prices of medical services significantly alters findings.

3.2. Data

The dataset is yearly and unbalanced, covering the 1997-2020 period. Data points to estimate equation (1) and its variants are from three sources:

- Centers for Disease Control and Prevention (CDC),
- Bureau of Labor Statistics (BLS),
- Kaiser Family Foundation (KFF).

Overall, six variables are considered for all 12 Midwestern states. Three variables prehend medical outcomes: (a) cancer mortality rate (CNCMR, per 100,000 total population), (b) heart disease mortality rate (HRTDMR, per 100,000 total population), and (c) infant mortality rate (INFMR, per 1,000 live births). Three other variables are introduced to keep track of changing economic environments across states: (i) healthcare spending per capita (HCSPPC), (ii) consumer price index for medical services (CPIMS), and (iii) real gross state product (RGSP).

4. Results and policy implications

4.1. Results

Exhibit 4 delivers a glimpse into the general characteristics of the dataset. Two variables in particular, HRTDMR and INFMR, appear to be normally distributed. The co-movements of variables indicate various levels of correlation with the highest and lowest noted with the pairs CPIMS-HCSPPC and RGSP-HCSPPC, respectively (see Exhibit 5).

Following the preliminary results, unit roots and cointegration analyses are performed.

Exhibit 4 – Descriptive Statistics

	HCSPPC	CPIMS	CNCMR	HRTDMR	INFMR	RGSP
Mean	6811.531	376.2359	160.7056	169.8935	6.085093	2.69E+11
Median	6886	382.092	158.3	166.5	6.12	2.57E+11
Maximum	12495	549.439	199.8	241.3	8.17	7.76E+11
Minimum	3313	228.1	137.8	114.9	2.77	2.24E+10
Std. Dev.	2073.539	98.58667	13.26044	26.54391	0.960303	1.97E+11
Skewness	0.104452	0.070267	0.837124	0.158631	-0.371683	0.796435
Kurtosis	2.090161	1.75664	3.617001	3.044285	3.352107	2.811724
Jarque-Bera	10.45737	18.00549	14.32708	0.461776	3.044577	30.87223
Probability	0.005361	0.000123	0.000774	0.793829	0.218212	0
Observations	288	276	108	108	108	288

[5] For conciseness' sake, this work does not elaborate on the VAR methodology. The literature is replete with a variety of theoretical and empirical studies incorporating the VAR methodology along with its extensions in the forms of BVAR, SVAR, among others. To name a few studies, see Litterman (1986), Watson (1994), Rudebusch (1998).

[6] Three types of medical outcomes are distinctly considered.

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As shown in Exhibit 6, group unit root tests reveal that variables are I(1).[7] Exhibit 7 points out that there exist cointegration vectors between variables using *Trace* and *Max-Eigenvalue* tests. They both identify two cointegrating vectors.

Exhibit 5 – Correlation Matrix

	HCSPPC	CPIMS	CNCMR	HRTDMR	INFMR	RGSP
HCSPPC	1	0.9652886	-0.68963	-0.23549988	-0.343402782	0.029374
CPIMS	0.965288616	1	-0.6191	-0.112067398	-0.275826567	0.073258
CNCMR	-0.68963243	-0.619102	1	0.762539033	0.611379828	0.266959
HRTDMR	-0.23549988	-0.112067	0.762539	1	0.586654085	0.416558
INFMR	-0.34340278	-0.275827	0.61138	0.586654085	1	0.293708
RGSP	0.029374488	0.0732582	0.266959	0.416558199	0.293707802	1

All in all, some engaging results are found regarding efficiency in the Midwestern region, and they are compiled in Exhibit 8. As far as CNCMR is concerned, HCSPPC increasing by one percent decreases it. This would somehow be expected with increased spending on a per capita basis. However, this decrease appears proportionally less at about -0.46 and -0.4 percent, respectively, in variants I and II. Such a finding cannot suggest per se the presence of inefficiencies, as it is essentially a necessary condition. A look at marginal effects of spending per capita can help derive a sufficient condition. The marginal effects of per capita outlays come out significant and positive in both variants. In other words, the latest dollar spent drives up cancer mortality in the region. This outcome is not a preferable one, as it indicates some level of inefficiency in the use or allocation of financial resources when trying to contain or reduce cancer mortality.

Exhibit 6 – Unit Roots Tests (H_0: Unit root)

	Individual intercept		
	Method	Statistic	Prob.
Level	Levin, Lin & Chu	1.88284	0.9701
	Individual intercept and trend		
	Method	Statistic	Prob.
First Difference	Levin, Lin & Chu	-334.531	0
	Breitung	-2.05007	0.0202

For the second medical outcome, HRTDMR, a similar pattern of negative and significant relationship is in order as in the previous case with respect to HCSPPC. However, it appears in this case that increasing healthcare outlays per capita by one percent leads to a more than proportional decrease in the mortality rate, at about -1.01 percent in variant I and a little below 1 percent at about 0.99 percent in variant II. These figures hence look relatively much better when compared with cancer mortality. A similarity is noted as well regarding the impact of the latest dollar spent, which accelerates, even further than in the previous case, the mortality rate for heart disease. This finding hardly suggests efficiency of per capita healthcare outlays in tackling heart disease mortality.

With respect to the third medical outcome, INFMR, the impact of per capita healthcare outlays, HCSPPC, does not appear conclusive from the outset in variant (I) owing to the unexpected fact that both positive and negative significances are detected. Variant (II) does not settle that confusion, as it reveals insignificance altogether regardless of the lag considered. On the other hand, results with marginal effects bring some level of clarity by revealing that the latest dollar spent exacerbates infant mortality in both variants. This finding does not depart from those already uncovered with cancer and heart disease mortality rates, but it appears more severe in this instance.

4.2. Policy Implications

By paralleling healthcare spending and medical outcomes in the US Midwest, this empirical inquiry has generally found evidence of lingering inefficiencies in the healthcare system. Healthcare systems in Midwestern states are achieving modest or below-expectation results considering the extent of financial resources allotted, specifically in reducing cancer, heart disease, and infant mortalities. It has been axiomatic for decades that the lack of resources, inadequate technology, and poor medical infrastructures do not constitute the culprits of the relatively poor performance observed. Attention must therefore be turned elsewhere to identify and address the elephant in the room, which largely feeds upon institutional and legislative rigidities.[8]

[7] In practice, cross-sectionally independent group unit root tests are performed using (i) individual intercept, and (ii) individual intercept and trend.
[8] It is true that clinical wastes can be single out as well, but they remain to some extent a by-product of the elephant in the room.

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Exhibit 7 – Johansen Cointegration Tests

	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Prob.
Trace	None *	0.76114	134.8473	47.85613	0
	At most 1 *	0.303609	31.75217	29.79707	0.0294
	At most 2	0.067564	5.699356	15.49471	0.7307
	At most 3	0.009161	0.662624	3.841465	0.4156
	Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value	Prob.
Maximum Eigenvalue	None *	0.76114	103.0952	27.58434	0
	At most 1 *	0.303609	26.05281	21.13162	0.0093
	At most 2	0.067564	5.036732	14.2646	0.7372
	At most 3	0.009161	0.662624	3.841465	0.4156
	At most 3	0.009161	0.662624	3.841465	0.4156

The Council of State Governments (CSG)[9] published a broadly distributed compendium of studies in 2022, which featured four major trends in the Midwest (CSG, 2022). Among others, rising costs of insurance were identified on that list. The report clearly states, *"The high cost-sharing people face in many employer, individual-market, and marketplace plans is primarily driven by the prices that providers, especially hospitals, charge to commercial insurers and employers."* It carries on adding, *"These prices are the highest in the world. And consumers bear the burdens."* In the Midwest, as in other regions of the US, market mechanisms are severely impaired due to a diverse pool of both institutional and legislative red tapes, which artificially put an upward pressure on prices of medical services and products owing to reduced competition and excessive moral hazard.

The deep-seated nature of these decades-long red tapes has fostered the growth and consolidation of a rampant rent-seeking industry that has virtually walled in the healthcare system in the Midwest, in particular, and nation, in general. Hence, this paper argues that the most impactful way forward to improve efficiency in the healthcare system in the Midwest is to shake down this wall. This process cannot survive outside political arenas represented by governor's offices and state assemblies. Besides, the practice consisting in charging exorbitant prices for medical devices and prescription drugs in the US and not other countries, by American and US-based corporations, is oftentimes economically driven in an environment without a clear and far-reaching legislation for regulation purposes. Reasonable legislation built upon compromises is both pursuable and achievable to balance such a practice without stifling innovations and investments, which are unarguably critical. Unless this is tackled in earnest, the burden borne by consumers, as noted by the 2022 CSG's report, will not lessen, or will worsen, because cost-sharing and medical corporations market-pricing models are two sides of the same coin. In such a context, the status quo of inefficiencies in state healthcare systems in the Midwest, and other US regions, with respect to some key medical outcomes will persist.

5. Conclusion

Healthcare outlays remain front and center in shaping budgets for households, states, and the Federal government. Looking into the relationship between healthcare spending and three medical outcomes, namely, cancer mortality, heart disease mortality, and infant mortality, this study has found empirical evidence suggesting some level of inefficiencies in healthcare systems in 12 Midwestern states. A close analysis moves this paper toward arguing that addressing institutional and legislative red tapes constitutes the main factor, but not the sole, that can move the needle in the right direction to improve efficiencies or reduce inefficiencies.

[9] The CSG's official website indicates that it was founded in 1933, and it is "the nation's largest nonpartisan organization serving all three branches of state elected and appointed officials." Retrieved in February 2024, and available at https://www.csg.org/about-us/

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Exhibit 8 – Estimation Outcomes[10]

	CNCMR		HRTDMR		INFMR	
Variables	Variant I	Variant II	Variant I	Variant II	Variant I	Variant II
$CNCMR_{-1}$	-0.444254***	-0.485401***	…	…	…	…
$CNCMR_{-2}$	-0.028582	-0.090749	…	…	…	…
$HRTDMR_{-1}$	…	…	-0.469521***	-0.491771***	…	…
$HRTDMR_{-2}$	…	…	0.068491*	0.077542	…	…
$INFMR_{-1}$	…	…	…	…	-0.893274***	-0.869042***
$INFMR_{-2}$	…	…	…	…	-0.970151***	-0.975218***
$INFMR_{-3}$	…	…	…	…	-0.566106***	-0.526326***
$HCSPPC_{-1}$	-0.461037***	-0.402378**	-1.011528***	-0.985702***	-2.72338*	-4.410681
$HCSPPC_{-2}$	-0.105678	-0.049438	0.21307	0.131984	6.58342***	4.018259
$HCSPPC_{-3}$	…	…	…	…	-0.685981	-1.30806
$HCSPPC*HCSPPC_{-1}$	5.553187***	5.198917***	9.98823***	9.535681***	33.77577***	40.99044*
$HCSPPC*HCSPPC_{-2}$	0.771678	-0.21783	-1.770949	-1.751923	-35.98729	-14.32041
$HCSPPC*HCSPPC_{-3}$	…	…	…	…	-11.27339	-7.294421
$RGSP_{-1}$	0.194829**	0.169729	0.125318	0.202372	0.580288	1.225764
$RGSP_{-2}$	-0.054838	0.02192	0.031328	0.065572	0.660851	-0.144734
$RGSP_{-3}$	…	…	…	…	0.422625	0.393622
$CPIMS_{-1}$	…	0.200311	…	0.569924	…	1.473011
$CPIMS_{-2}$	…	0.441874	…	0.026985	…	-5.129744
$CPIMS_{-3}$	…	…	…	…	…	-2.475693
C	-0.02218*	-0.05562*	0.013422	-0.011063	-0.245218	0.183704
R-squared	0.610026	0.619988	0.533163	0.542574	0.696132	0.707677
Adj. R-squared	0.560506	0.557691	0.473882	0.467587	0.618549	0.608021
F-statistic	12.31868	9.952122	8.993851	7.235503	8.9727	7.10123
Log likelihood	204.148	205.0795	174.6731	175.4063	61.39316	62.55519

References

1. Bailey, V. (2022). “Clinical Waste Accounts for Up to 15% of All Healthcare Spending.” Xtelligent Healthcare Media, in RevCycleIntelligence. Available at https://revcycleintelligence.com/news/clinical-waste-accounts-for-up-to-15-of-all-healthcare-spending.
2. Basmann, R.L. 1957. “A generalized classical method of linear estimation of coefficients in a structural equation.” *Econometrica*, 25: 77–83.
3. Himmelstein, D.U., E. Warren, D. Thorne, and S. Woolhandler (2005). "Illness and Injury as Contributors to Bankruptcy." *Health Affairs*, 24(1): 63.
4. Litterman, R. B. (1986). “Forecasting With Bayesian Vector Autoregressions: Five Years of Experience.” *Journal of Business and Economic Statistics*, 4(1): 25–38.
5. Michelly Gonçalves Brandão, S., H.-P. Brunner-La Rocca, A. C. Pedroso de Lima, and E. Alcides Bocchi (2023). “A review of cost-effectiveness analysis: From theory to clinical practice.” *Medicine*, 102(42): e35614. | DOI: 10.1097/MD.0000000000035614
6. Olivares-Tirado, P. and R. Zanga (2023). “Waste in health care spending: A scoping review.” *International Journal of Healthcare Management*, March 2023: 1-13.

7. Organisation for Economic Co-operation and Development (OECD), 2017. “Tackling Wasteful Spending on Health.” OECD, Paris,

[10] Optimal lags are 2, 2, and 3, respectively, for CNCMR, HRTDMR, and INFMR according to AIC.

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France. URL: oe.cd/tackling-wasteful-spending-on-health.
8. Rudebusch, G.D. (1998). “Do Measures of Monetary Policy in a VAR Make Sense?” *International Economic Review*, 39(4): 907–31.
9. Sargan, J.D. (1958). “The estimation of economic relationships using instrumental variables.” *Econometrica*: *Journal of the Econometric Society*, 26: 393–415.
10. The Council of State Governments (2022). Retrieved in February 2024. Available at https://www.csg.org/2022/12/15/state-of-health-coverage-in-the-midwest-four-takeaways-from-studies-showing-a-drop-in-uninsured-but-continued-disparities-and-rising-costs/
11. Theil, H. (1953a). *Repeated least-squares applied to complete equation systems*. The Hague: Central Planning Bureau (mimeographed).
12. Theil, H. (1961). *Economic forecasts and policy*, 2nd ed. Amsterdam: North-Holland.
13. Watson, M. W. (1994). “Vector Autoregressions and Cointegration,” in *Handbook of Econometrics*, Vol. IV. Robert Engle and Daniel McFadden, eds. Amsterdam: Elsevier Science Ltd.: 2844–915.
14. Zarulli, V, E. Sopina, V. Toffolutti, and A. Lenart (2021). “Health care system efficiency and life expectancy: A 140-country study”. *PLoS One*, 16(7): e0253450. doi:10.1371/journal.pone.0253450

DOI: 10.5281/zenodo.11111888