WORKING PAPER 274/2025

Efficiency Decomposition of Public Expenditure – Evidence from Indian States

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January 2025

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Efficiency Decomposition of Public Expenditure – Evidence from Indian States

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Abstract

Assessing the efficiency of public expenditure and identifying the origins of inefficiency is imperative for any government to design effective policy measures. This study aims to decompose the efficiency of health and education expenditure of major Indian states as a two-stage process in which the first stage is infrastructure development and the second is service delivery. Using a two-stage relational Data Envelopment Analysis of Kao and Hwang (2008) for the year 2019-20, the empirical findings from this study suggest a significant variation in efficiency across the states in these two stages. Further, it also identifies that the governance of a state matters only in the infrastructure stage and not in the service delivery stage. The results from this study will help the states understand the stage where they have deficiencies and design their policy for improvement.

Keywords: *Public Expenditure Efficiency, Data Envelopment Analysis, Two-stage Relational DEA, Governance*
JEL Codes: *H72, C61, I1, I2*

Acknowledgement

The authors thank all the participants of the second annual conference on public finance and policy organised by the centre for public finance, Madras School of Economics during March 7 – 8, 2024, for their valuable and insightful suggestions. A revised version of this paper is being considered as a chapter in the upcoming book provisionally titled India's Public Finance and Policy Challenges in the 2020s.

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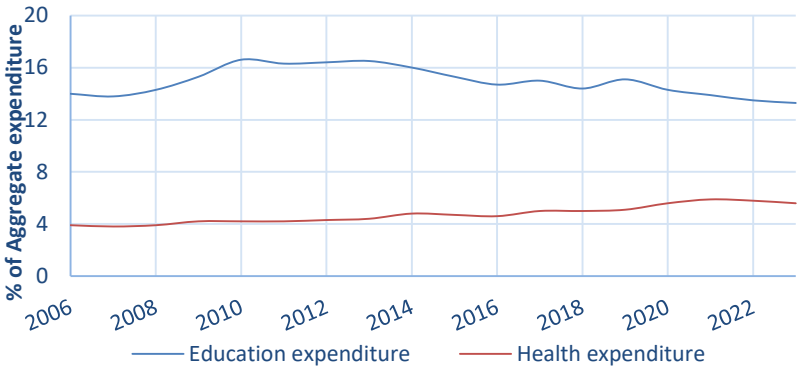
INTRODUCTION

Social sector investment plays a significant role in the development of any society. Governments pay the most attention to allocating and utilizing funds for the social sector, and India is no exception. Public policies in this direction have evolved from the idea of a welfare state by allocating more towards the social sector and examining its real effects. The recent budget (2023-24) of the Government of India allocated 41.6 percent of the aggregate expenditure to the social sector. As per the seventh schedule of the Indian constitution, education is in the concurrent list (subject of common interest to the Union and states), and health is in the state list, highlighting the role of the states in providing these merit goods. Expenditure on medical, public health, and family welfare of all states and union territories combined stood at 5.6 percent of aggregate expenditure (1.1 percent to GDP), and the corresponding figure for education was 13.3 percent (2.5 percent to GDP) in 2023-24. Given the direct impact on human capital development, which will eventually lead to long-term positive economic growth outcomes, education, and health play a prime role in public policy discussions. India has consistently spent 10 to 15 percent of its expenditure on education and 3 to 5 percent on health for the last fifteen years (see Figure 1a). However, both these expenditures account for only less than 3% of GDP (Figure 1b).

Furthermore, the share of education and health expenditure to total expenditure significantly varies across Indian states. For instance, Chhattisgarh has spent close to three times (18.2%) of Telangana's expenditure on education as a percentage of total spending (6.5%) in 2023-24. Similarly, Goa's health expenditure (8.7%) is three times that of Punjab's expenditure (2.9%). Figure 2 gives detailed state provisions towards health and education as a percentage of the corresponding state's total expenditure in 2023-24. The figure shows that there are states like Assam, Bihar, Chhattisgarh, Himachal Pradesh, Nagaland, Rajasthan, Sikkim, and Uttarakhand that spend more than 15 percent of

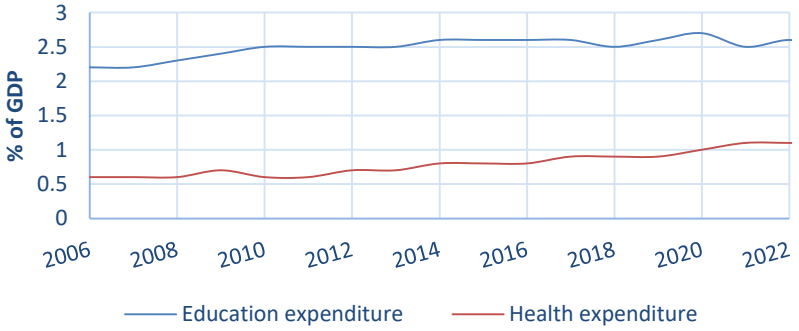
their total expenditure on education. Similarly, we have Goa, Meghalaya, Odisha, Rajasthan, and Uttar Pradesh spending close to 7 percent or more of their total expenditure on health.

Figure 1a: Percentage of Education and Health Expenditure as a Ratio of Aggregate Expenditure



Source: State finances: A study of budget (RBI)

Figure 1b. Percentage of Education and Health Expenditure as a Ratio of GDP



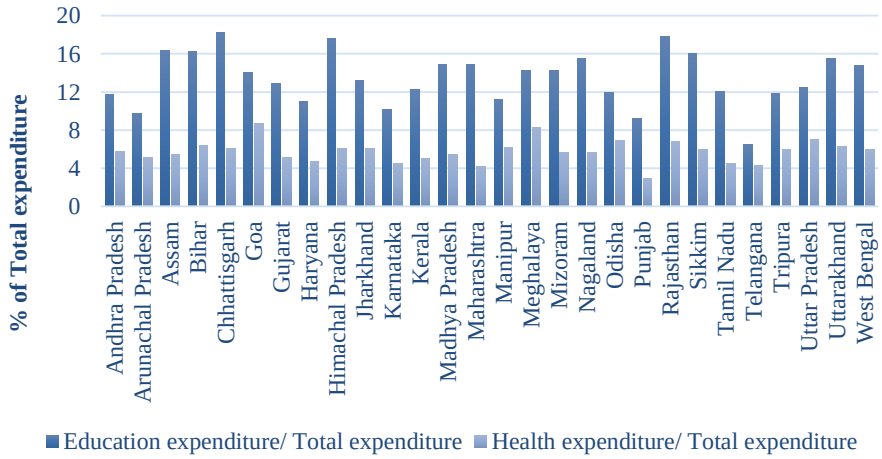
Source: State finances: A study of budget (RBI)

We can see that the variation across states is not just present in the context of outlays but rather in the context of outcomes as well. Figure 3 captures the data on two of the main outcomes targeted by

expenditures on education and health – Gross Enrolment Ratio (GER) in higher education and Life Expectancy (LE) for the year 2019-20. As we can see, there is variation across states in terms of realising these outcomes, particularly so in case of the Gross Enrolment ratio as the numbers varies between 14 to 51 across states.

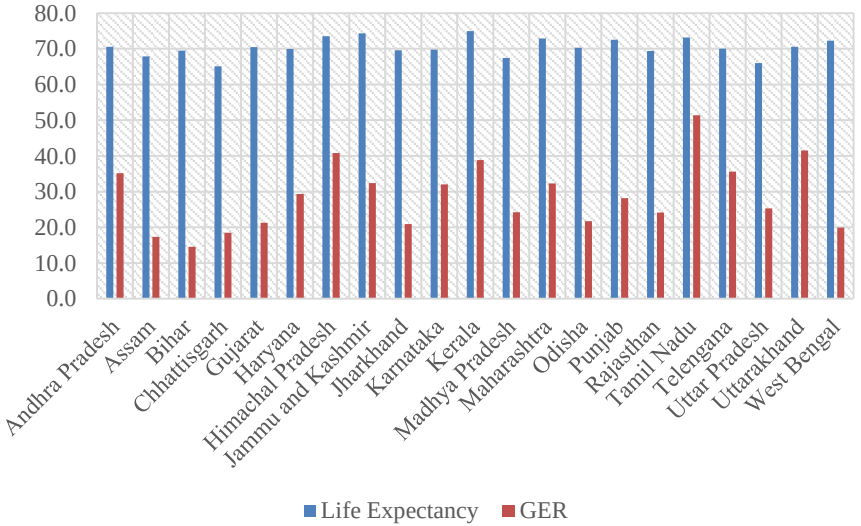
The positive externalities associated with education and health call for spending expansion towards these sectors; however, there are natural restrictions imposed by governments' revenue and the fiscal road map prescribed by the Fiscal Responsibility and Budget Management (FRBM) Act limiting the spending capacity of states. As a result, various states allocate different slices of the respective total pie to these sectors. At the same time, significant regional disparities exist among states with respect to the outcomes generated by their spending on education and health. These substantial differences in health and education outcomes across states necessitate the assessment of the quality of public expenditure.

Figure 2: Expenditure on Education and Health as a Percentage of the Total Spending of Indian States Based on the Budget Estimates of 2023-24.



Source: State finances: A study of budget (RBI)

Figure 3: Life Expectancy and Gross Enrolment Ratio (GER) for Higher Education for the Year 2019-20.



Source: Health and Family Welfare Statistics and Unified District Information system for Education repost.

A government is said to be utilizing its resources efficiently when it can produce the maximum possible outputs with the least possible quantity of inputs. One can understand the efficiency in spending by analysing the money spent for the resources used by the ministry or a program (inputs) and the services delivered (outcomes achieved). In understanding this connection between public expenditure and the services provided and to empirically quantify it, some studies used nonparametric or parametric approaches for the analysis.

Several studies indicate significant inefficiencies in government spending on health and education in advanced economies as well as in emerging and developing ones. Gupta and Verhoeven (2001) examined the efficiency of education and health spending in Africa for a sample of 85 countries during 1984–95 and found that African economies are inefficient in providing health services relative to their Asian and Western

Hemisphere peers. They also found that, on average, the level of inefficiency is positively correlated with the level of government expenditure. Fakin and Crombrugghe (1997) and Afonso and Aubyn (2005, 2006) explored the efficiency of public expenditure in the OECD countries and found significant variations amongst the panel and suggested a substantial potential for expenditure saving in most of them. Gupta et. al (2007) checked the efficiency of health and education spending for a sample of 50 low-income countries. The results suggest that countries with the lowest income per capita have the lowest efficiency scores and that there is significant room for increasing spending efficiency.

Grigoli and Kapsoli (2013) measure public expenditure inefficiency in the health sector for a sample of 80 emerging and developing economies over the 2001–10 period and their findings suggest that African economies have the lowest efficiency, whereas the top positions in the efficiency ranking are dominated by Western Hemisphere and Asian economies. For a different sample of OECD countries, Dutu and Sicari (2016) have identified considerable differences in the efficiency of spending on education, health care, and other public services.

In the Indian context, there are a couple of studies which explored the efficiency aspect of health and education spending across states. Sankar and Kathuria (2004) investigated the performance of rural public health system of 16 major states in India by using both the DEA approach, and the stochastic production frontier model, their results show that not all the states with better health indicators have efficient health systems. Through exploring the efficiency of health care system across 15 major Indian states between the 6^{th} to 10^{th} five-year plans P. De et al (2012) concludes that inefficiency in health system is mostly explained by the four variables, namely, female literacy, poverty level, child immunization, and institutional delivery. Purohith (2014) suggested a considerably more scope for improvement in efficiency of public expenditure in health relative to education across Indian states. Apart

from this, a couple of studies (Bhat et. al (2001), Sengupta & Mondal (2009), and Dash et. al (2010)) explored the efficiency of hospitals and health care delivery in different states.

Mohanty and Bhanumurthy (2020) assessed the subnational public expenditure efficiency on education and health using a mix of outputs and inputs. They showed a wide divergence in efficiency levels across states; overall, the states appeared to be spending efficiently on education. Further, they also identified that state governance matters in improving overall efficiency.

An important aspect missing in these studies is that they considered a direct single-stage connection between public expenditure on education and health as an input and a set of desired outputs like Gross enrolment ratio and Infant mortality rate. A possible drawback to the simple input–outcome framework lies in identifying the origin of inefficiency. It works in two or more stages. In a two-stage framework, the first is the connection between public expenditure in creating infrastructure and the second is delivering the services by the built infrastructure. Assessing public expenditure efficiency in two stages provides information on where the inefficiency originates, in the infrastructure creation or the service delivery. Approaching it this way helps the states have better public policy choices and address where it is lacking.

Mohanty and Bhanumurthy (2020) also found that the level of state governance affects the efficiency levels across states. The difference in governance can describe the difference in infrastructure created across states, not necessarily the service delivery and vice versa. So, it is imperative to identify the origins of inefficiency and where they stem from for devising better policies. Apart from this, understanding the differences across states in achieving infrastructure and service delivery efficiency and comparing it with overall efficiency will enrich the policy discussions further.

Given this background, this paper tries to assess the public expenditure efficiency of health and education in the Indian states by exploring the relationship between a set of inputs, intermediaries, and outputs using a relational two-stage Data Envelopment Analysis (DEA) method developed by Kao and Hwang (2008). As emphasized, our attempt is to identify where the inefficiency in spending originates, whether in stage 1 (infrastructure creation) or in stage 2 (service delivery). Further, this should help frame more informed policies towards addressing the regional disparity in education and health outcomes across states. To the best of our knowledge, this is the first study to assess the public expenditure efficiency as a two-stage process and we have also tried to incorporate more outcome variables as compared to the existing studies.

DATA AND METHODOLOGY

Two-stage Data Envelopment Analysis

A relative two-stage Data Envelopment Analysis (DEA) method developed by Kao and Hwang (2008) is used in this study. This method will help us to arrive at the relative efficiency of a set of decision-making units that apply the same inputs to produce the same outputs.

For *N* Decision Making Units (DMU) DMU_k, $k = 1. . . N$, the conventional DEA model for measures efficiency of k^{th} DMU under the assumption of constant returns-to-scale with X_{ij}, $i = 1 \ldots m$ and Y_{rj}, $r = 1, \ldots, s$ as the i^{th} input and r^{th} output, respectively, as follows.

$$E_k = max \sum_{r=1}^{s} u_r Y_{rk} \; / \; \sum_{i=1}^{m} v_i X_{ik}$$
$$s.t. \sum_{r=1}^{s} u_r Y_{rj} \; / \; \sum_{i=1}^{m} v_i X_{ij} \; \leq \; 1 \, , j = 1, \ldots , n, \qquad (1)$$
$$u_r, v_i \geq \varepsilon, \quad r=1,\ldots..,s; \; i=1,\ldots.,m,$$

Where ε is a small non-Archimedean number (Charnes et al., 1979; Charnes and Cooper, 1984) and E_K is the relative efficiency of DMU_K, where $E_K = 1$ indicates efficiency and $E_K < 1$ for inefficiency. Now, suppose a production process is composed of a series of two sub-

processes with *q* intermediate products Z_{pk}, *p = 1… q*, Kao and Hwang (2008) proposed the following linear program:

$$
\begin{aligned}
&E_k = max \textstyle\sum_{r=1}^{s} u_r Y_{rk} \\
&s.t.\ \textstyle\sum_{i=1}^{m} v_i\ X_{ik} = 1, \\
&\textstyle\sum_{r=1}^{s} u_r Y_{rj} - \sum_{i=1}^{m} v_i X_{ij} \le 0, \quad j=1,...,n, \\
&\textstyle\sum_{p=1}^{q} w_p Z_{pj} - \sum_{i=1}^{m} v_i X_{ij} \le 0, \quad j=1,...,n, \\
&\textstyle\sum_{r=1}^{s} u_r Y_{rj} - \sum_{p=1}^{q} w_p Z_{pj} \le 0, \quad j=1,....,n, \\
&u_r, v_i, w_p \ge \varepsilon,\ r=1,.....,s;\ i=1,.....,m\ ;\ p=1,...,q,
\end{aligned}
\tag{2}
$$

After the optimal multipliers u_r^*, v_i^* and w_p^* are solved, the efficiencies are obtained subsequently as $E_k = \sum_{r=1}^{s} u_r Y_{rk}$, $E_k^1 = \sum_{p=1}^{q} w_p Z_{pk} / \sum_{i=1}^{m} v_i X_{ik}$ and $E_k^2 = \sum_{r=1}^{s} u_r Y_{rj} / \sum_{p=1}^{q} w_p Z_{pj}$, this obviously implies $E_k = E_k^1 * E_k^2$. Kao and Hwang (2008) highlighted that the optimal multipliers solved from (2) may not be unique; consequently, the decomposition of $E_k = E_k^1 * E_k^2$ would not be unique, either. They provide a solution to this problem by finding the set of multipliers which produces the largest E_k^1 while maintaining the overall efficiency score at E_k calculated from equation (2) as follows

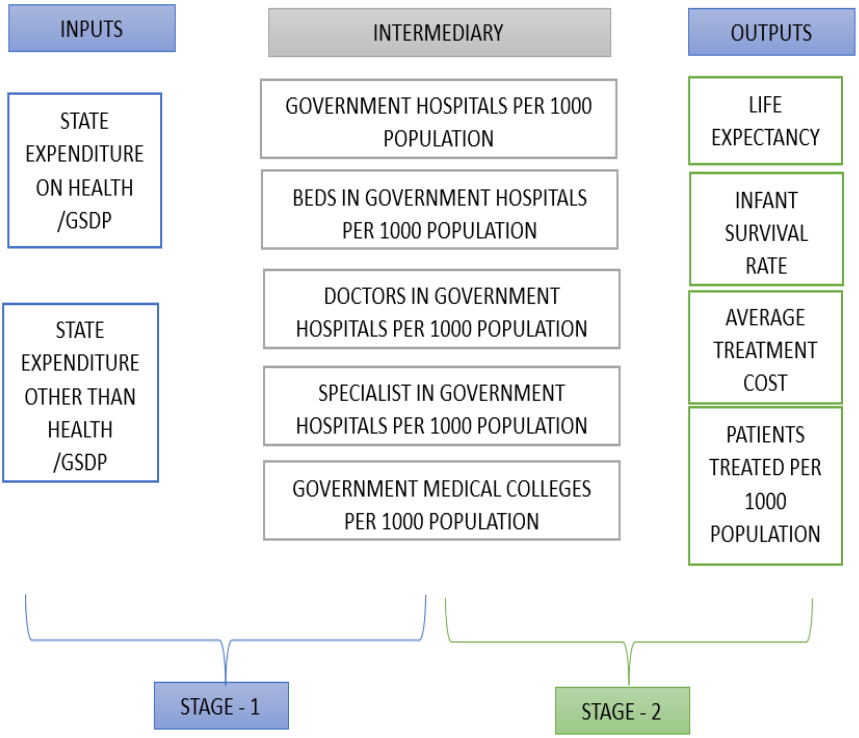
$$
\begin{aligned}
&E_k^1 = max \textstyle\sum_{p=1}^{q} w_p Z_{pk} \\
&s.t. \textstyle\sum_{i=1}^{m} v_i\ X_{ik} = 1, \\
&\textstyle\sum_{r=1}^{s} u_r Y_{rk} - E_k \sum_{i=1}^{m} v_i X_{ik} = 0 \\
&\textstyle\sum_{r=1}^{s} u_r Y_{rj} - \sum_{i=1}^{m} v_i X_{ij} \le 0, \quad j=1,.....,n, \\
&\textstyle\sum_{p=1}^{q} w_p Z_{pj} - \sum_{i=1}^{m} v_i X_{ij} \le 0, \quad j=1,....,n, \\
&\textstyle\sum_{r=1}^{s} u_r Y_{rj} - \sum_{p=1}^{q} w_p Z_{pj} \le 0, j=1,.....,n, \\
&u_r, v_i, w_p \ge \varepsilon,\ r=1,.....,s;\ i=1,.....,m\ ;\ p=1,.....,q,
\end{aligned}
\tag{3}
$$

After E_k^1 is calculated from the above model, the efficiency of the second stage is obtained as: $E_k^2 = E_k / E_k^1$.

Data

The variables used to represent the inputs, intermediaries, and outputs for the two-stage relational DEA analysis for health and education expenditure are illustrated in Figure 4 and Figure 5, respectively.

Figure 4: Two-Stage Relational DEA for Health Expenditure

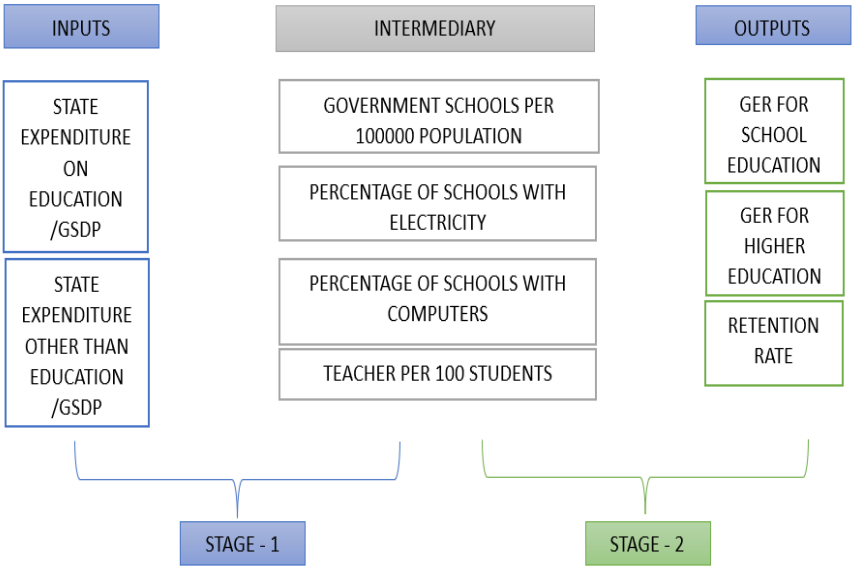


The efficiency of public expenditure for health and education is calculated for 21 and 29 Indian states, respectively, for 2019 – 2020[1]. The number of states chosen is purely based on the availability of data. The data on all public expenditure-related variables are obtained from State Finances: A Study of Budget published by the Reserve Bank of

[1] The state of Jammu and Kashmir was split into two new union territories of Jammu and Kashmir and Ladakh on 31st October 2019 (Jammu and Kashmir Reorganisation Act, 2019).

India, and are averaged over three periods (2016-2019). The intermediary variables on health are obtained from the Handbook of Statistics on Indian States published by the Reserve Bank of India and Health and Family Welfare Statistics in India, 2019-20. The respective educational variables are obtained from the Unified District Information System for Education Report 2019-20. The State-wise Multidimensional Poverty Index data is from the NFHS-5 report and the variable Public Affairs Index is sourced from the Public Affairs Centre of People's Archive of Rural India (PARI).

Figure 5: Two-Stage Relational DEA for Education Expenditure



RESULTS AND DISCUSSION

The way this paper defines the process of pubic expenditure resulting in health and educational outcomes as follows: expenditure from the states will create a set of required infrastructure (insfratructure stage) which will further help in delivering a set of services (service delivery stage), which are essentially the outcomes. To start with, we derive the independent stage-wise efficiency score using constant returns to scale

DEA, and the results are presented in Tables 1 and 2, for health and education expenditure respectively. The overall efficiency score is captured as E_{XY} (where X represents inputs and Y represents the outcomes). The independent stage wise efficiency scores for stage 1 and stage 2 are captured in E_{XZ} and E_{ZY} respectively (where Z denotes the intermediary).

The results for health expenditure across states indicate that four states, namely Gujarat, Kerala, Maharashtra, and Tamil Nadu, are benchmarked as best-performing states in overall efficiency, whereas this is not the case with divisional efficiency. Tamil Nadu is benchmarked as efficient in both the input-intermediary stage and the intermediary-output stage. But the other three states are benchmarked only in the intermediary to output stage. Similarly, in education expenditure, four states, namely Gujarat, Maharashtra, Tamil Nadu, and Telangana, are benchmarked as best-performing states in overall efficiency but differ in divisional efficiency. These four states are benchmarked as efficient in the input-intermediary stage but not in the intermediary-output stage, except Tamil Nadu and Maharashtra. As per the overall efficiency score for health expenditure, the most inefficient states are Bihar, Jammu and Kashmir, Assam, and Jharkhand respectively. On the other hand, the least efficient states in case of education expenditure are Arunachal Pradesh, Mizoram, Nagaland, and Meghalaya respectively. Independent stage wise analysis of health expenditure also shows that, except a few states most are benchmarked in stage 2, highlighting the importance to focus more on stage 1. However, divisional efficiency scores of education expenditure display inefficiency across both stages.

The drawbacks of the independent stage-wise DEA are overcome through relational two-stage DEA results reported in Tables 3 and 4, respectively. In the tables, E_k is the overall efficiency, E_k^1 is the infrastructure stage efficiency and E_k^2 is the efficiency in the service delivery stage. For health expenditure, except Tamil Nadu, the other three states benchmarked as efficient are not benchmarked in overall

efficiency. At the same time, Kerala's efficiency slid by 19 percent, while Gujarat and Maharashtra decreased by 58.6 percent and 46.7 percent, respectively. In the context of education expenditure, none of the states are benchmarked as efficient overall. While there is an efficiency decline close to 7.5 percent in Tamil Nadu and Telangana, for Gujarat and Maharashtra, the decrease is 27 percent and 21 percent, respectively.

Table 1: Independent Stage-wise DEA Results for Health Expenditure

S. No	State	E_{XY}	Rank	E_{XZ}	Rank	E_{ZY}	Rank
1	Andhra Pradesh	0.661	11	1	1	0.666	16
2	Assam	0.426	19	0.370	15	0.479	18
3	Bihar	0.354	21	0.135	21	1	1
4	Chhattisgarh	0.454	17	0.306	18	1	1
5	Gujarat	1	1	0.712	9	1	1
6	Haryana	0.827	6	0.565	14	0.825	14
7	Himachal Pradesh	0.468	15	1	1	0.282	21
8	Jammu and Kashmir	0.372	20	0.575	13	0.768	15
9	Jharkhand	0.453	18	0.824	6	1	1
10	Karnataka	0.841	5	1	1	0.423	19
11	Kerala	1	1	0.811	7	1	1
12	Madhya Pradesh	0.515	13	0.256	19	1	1
13	Maharashtra	1	1	0.723	8	1	1
14	Odisha	0.505	14	0.361	16	0.838	13
15	Punjab	0.768	7	0.601	12	1	1
16	Rajasthan	0.522	12	0.353	17	0.539	17
17	Tamil Nadu	1	1	1	1	1	1
18	Telangana	0.705	10	0.615	11	1	1
19	Uttar Pradesh	0.458	16	0.162	20	1	1
20	Uttarakhand	0.716	8	1	1	0.356	20
21	West Bengal	0.716	8	0.635	10	1	1

Table 2: Independent Stage-wise DEA Results for Education Expenditure

S. No	State	E_{XY}	Rank	E_{XZ}	Rank	E_{ZY}	Rank
1	Andhra Pradesh	0.730	13	0.929	13	0.829	21
2	Arunachal Pradesh	0.202	29	0.494	25	0.982	13
3	Assam	0.436	22	0.895	14	0.725	24
4	Bihar	0.459	21	0.445	28	0.970	14
5	Chhattisgarh	0.495	20	0.983	10	0.597	28
6	Goa	0.761	11	0.744	21	1	1
7	Gujarat	1	1	1	1	0.729	23
8	Haryana	0.975	5	0.863	15	1	1
9	Himachal Pradesh	0.631	14	1	1	0.822	22
10	Jammu and Kashmir	0.383	23	0.755	20	0.689	25
11	Jharkhand	0.578	16	0.823	16	0.687	26
12	Karnataka	0.968	6	1	1	1	1
13	Kerala	0.938	8	0.952	11	1	1
14	Madhya Pradesh	0.523	19	1	1	0.992	12
15	Maharashtra	1	1	1	1	1	1
16	Manipur	0.383	23	0.469	27	1	1
17	Meghalaya	0.307	26	1	1	1	1
18	Mizoram	0.286	28	0.708	22	0.540	29
19	Nagaland	0.298	27	0.415	29	0.833	20
20	Odisha	0.557	18	0.940	12	0.638	27
21	Punjab	0.890	9	0.779	19	0.963	15
22	Rajasthan	0.623	15	0.599	23	0.898	18
23	Sikkim	0.949	7	0.793	18	1	1
24	Tamil Nadu	1	1	1	1	1	1
25	Telangana	1	1	1	1	0.930	17
26	Tripura	0.354	25	0.472	26	0.960	16
27	Uttar Pradesh	0.562	17	0.509	24	1	1
28	Uttarakhand	0.845	10	1	1	1	1
29	West Bengal	0.749	12	0.803	17	0.884	19

Table 3: Relational Two-stage DEA Results for Health Expenditure

S. No	State	E_k	Rank	E_k^1	Rank	E_k^2	Rank
1	Andhra Pradesh	***0.407***	5	***0.878***	5	***0.464***	15
2	Assam	***0.137***	20	***0.367***	15	***0.373***	18
3	Bihar	***0.135***	21	***0.135***	21	***1***	1
4	Chhattisgarh	***0.266***	11	***0.266***	18	***1***	1
5	Gujarat	***0.414***	4	***0.591***	8	***0.702***	12
6	Haryana	***0.389***	9	***0.557***	9	***0.700***	13
7	Himachal Pradesh	***0.216***	14	***1***	1	***0.216***	21
8	Jammu and Kashmir	***0.181***	17	***0.402***	14	***0.450***	16
9	Jharkhand	***0.181***	16	***0.644***	7	***0.282***	19
10	Karnataka	***0.402***	6	***1***	1	***0.402***	17
11	Kerala	***0.810***	2	***0.810***	6	***1***	1
12	Madhya Pradesh	***0.248***	12	***0.248***	19	***1***	1
13	Maharashtra	***0.533***	3	***0.534***	10	***0.999***	7
14	Odisha	***0.214***	15	***0.292***	17	***0.732***	10
15	Punjab	***0.394***	7	***0.487***	11	***0.809***	9
16	Rajasthan	***0.174***	18	***0.351***	16	***0.496***	14
17	Tamil Nadu	***1***	1	***1***	1	***1***	1
18	Telangana	***0.337***	10	***0.461***	13	***0.730***	11
19	Uttar Pradesh	***0.160***	19	***0.160***	20	***1***	1
20	Uttarakhand	***0.243***	13	***1***	1	***0.243***	20
21	West Bengal	***0.392***	8	***0.481***	12	***0.815***	8

In Table 3, even though Kerala is having 0.81 efficient which is next to Tamil Nadu, the lacking is happening in the infrastructure state because they are benchmarked as 1 in the service delivery stage. So, if the government concentrates more on creating infrastructure, then there is scope for improving Kerala's efficiency to previous level. Similar is the case with states like Bihar, Chhattisgarh, Madhya Pradesh, and Uttar Pradesh as they are all benchmarked in stage 2 with the respective infrastructure that is created in these states as we can see that all these four states show relatively high inefficiency in Stage 1. The states that are benchmarked in stage 1 and displays an inefficient performance in stage 2 are Himachal Pradesh, Karnataka, and Uttarakhand.

Similarly, in Table 4, even though Tamil Nadu ranks first and Telangana very close with 0.925 and 0.924 respectively, we see the two states are benchmarked at different stages as per the divisional scores - at the service delivery stage and infrastructure stage respectively. The only other state that is benchmarked in stage 1 is Gujarat. However, we observe many states being benchmarked in the service delivery stage – Haryana, Kerala, Manipur, Sikkim, and Uttar Pradesh.

Overall, the relational two-stage DEA gives a better understanding of the stage in which the states are lacking. We could observe that, in the divisional efficiency there are a smaller number of benchmarked states in stage 1 (infrastructure stage), both in case health and education expenditure compared to stage 2 (service delivery stage).

Finally, we tried to explore what are the factors that determine the efficiency. The study uses correlation analysis between the three efficiency scores that we have from the two-stage relational DEA and two possible determinants – Multidimensional Poverty Index and the other is the Public Affairs Index (PAI - an indicator of governance). The results reported in Table 5 show that, governance matters in the overall and the infrastructure stage (stage 1). However, we can see that the correlation between the efficiency score in stage 2 and the public affairs index is very less (close to zero), indicating that governance does not play a strong role in the service delivery stage both in case of the health and education expenditure. On the other hand, we can see that the Multidimensional Poverty Index (MPI) matters. If the government reduces the MPI, which in turn means an improvement in the standard of living, that could possibly increase overall efficiency and the efficiency in both the stages.

Table 4: Relational Two-stage DEA Results for Education Expenditure

S. No	State	E_k	Rank	E_k^1	Rank	E_k^2	Rank
1	Andhra Pradesh	***0.559***	11	***0.696***	14	***0.802***	13
2	Arunachal Pradesh	***0.176***	29	***0.433***	24	***0.406***	28
3	Assam	***0.341***	23	***0.637***	20	***0.536***	25
4	Bihar	***0.358***	21	***0.404***	26	***0.887***	10
5	Chhattisgarh	***0.381***	20	***0.739***	8	***0.516***	26
6	Goa	***0.544***	12	***0.647***	18	***0.842***	12
7	Gujarat	***0.729***	6	***1***	1	***0.729***	19
8	Haryana	***0.722***	7	***0.722***	10	***1***	1
9	Himachal Pradesh	***0.469***	14	***0.640***	19	***0.733***	18
10	Jammu and Kashmir	***0.312***	24	***0.573***	21	***0.544***	24
11	Jharkhand	***0.442***	16	***0.676***	16	***0.655***	21
12	Karnataka	***0.732***	5	***0.932***	4	***0.786***	16
13	Kerala	***0.712***	8	***0.712***	11	***1***	1
14	Madhya Pradesh	***0.390***	19	***0.649***	17	***0.601***	22
15	Maharashtra	***0.790***	4	***0.895***	6	***0.883***	11
16	Manipur	***0.348***	22	***0.348***	27	***1***	1
17	Meghalaya	***0.239***	27	***0.707***	13	***0.339***	29
18	Mizoram	***0.215***	28	***0.492***	23	***0.437***	27
19	Nagaland	***0.241***	26	***0.324***	29	***0.744***	17
20	Odisha	***0.422***	17	***0.707***	12	***0.598***	23
21	Punjab	***0.667***	10	***0.738***	9	***0.904***	8
22	Rajasthan	***0.450***	15	***0.501***	22	***0.898***	9
23	Sikkim	***0.792***	3	***0.792***	7	***1***	1
24	Tamil Nadu	***0.925***	1	***0.925***	5	***1***	1
25	Telangana	***0.924***	2	***1***	1	***0.924***	7
26	Tripura	***0.274***	25	***0.342***	28	***0.801***	14
27	Uttar Pradesh	***0.421***	18	***0.421***	25	***1***	1
28	Uttarakhand	***0.675***	9	***0.966***	3	***0.699***	20
29	West Bengal	***0.541***	13	***0.685***	15	***0.791***	15

Table 5: Determinants of Efficiency

	Ek	**Ek1**	**Ek2**
Public expenditure on Health			
Correlation- PAI	0.591	0.422	0.060
Correlation - 1/MPI	0.630	0.326	0.253
Public expenditure on Education			
Correlation- PAI	0.408	0.436	0.040
Correlation - 1/MPI	0.296	0.112	0.326

CONCLUDING REMARKS

The positive impact of social sector expenditure on economic development via enhancing human development at various levels is assumed to be imbibed in the way states make their public expenditure strategies. The outlays by various state governments are expected to translate into outcomes that show improvement in different aspects of human development. The effectiveness of those expenditures in achieving the stated goals is the focus of this paper. To this end, Using the two-stage relational DEA model developed by Kao and Hwang (2008), the paper decomposes the efficiency of public expenditure in health and education. Three efficiency scores are calculated – overall efficiency, efficiency at the input to intermediary stage, and intermediary to output stage. Further the paper also attempts to find the determinants of efficiency through a correlation analysis.

The results show that, compared to analysing the overall efficiency, divisional efficiency gives a better picture with respect to the expenditure efficiency of the states. According to the relational DEA results, the only state that is benchmarked in the context of health expenditure is Tamil Nadu. On the other hand, none of the states are benchmarked as one in the context of spending on education. Further, the findings clearly indicate whether the inefficiency is originating at the infrastructure stage or the service delivery stage. In case of health expenditure, there is greater inefficiency at the infrastructure stage for states such as Bihar, Chhattisgarh, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Odisha, Panjab, Rajasthan, Telangana, Uttar Pradesh, and West Bengal – thirteen out of the twenty-one states that we considered for the analysis. Similarly for education expenditure, efficiency scores are lower in stage 1 for nearly fifteen states. The results indicate that, the required intervention for improving efficiency is different across states.

The results from the correlation analysis prove that the impact that governance can have on efficiency is limited to stage 1 (infrastructure stage). It implies that improving governance alone might not be sufficient to improve overall efficiency. Overall, the study gives an idea of where each state is placed in terms of efficiency and thereby helps in developing the policy prescriptions. For certain states the progress they make in the governance parameters will boost expenditure efficiency whereas in many other states like the northeastern states there needs to be focused interventions in the service delivery aspects as well to better the efficiency scores.

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