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Research Article

Linkages between Investment Potential and Quality of Educational Institutions: Evidence from India

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Using disparate datasets, one on the quality of higher education institutions (HEIs) in India comprising 348 HEIs that were accredited over the years 2004–2008, and another on the investment potential of states based on four indicators, we fail to find a correlation between the investment potential of a state and the mean efficiency of its HEIs computed using nonparametric data envelopment analysis (DEA). However, interactions of investment potential indicators with HEI scores on seven quality assessment criteria exhibit a significant impact on efficiency scores thereby suggesting a latent moderating effect. We conclude that the investment potential moderates the quality assessment of HEIs, but these indicators do not affect the efficiency of HEIs. A direct policy implication of the study is a latent link between HEI quality and investment potential of a state but not an overt one. Moreover, a state's infrastructure interacts with teaching and learning to affect HEI efficiency positively, whereas research output and good political governance interact to affect efficiency positively and significantly.

1. Introduction

Research on higher education institutions (HEIs) in developed countries (the US and the UK) shows that these institutions operate under forces of marketization that demand competitiveness, efficiency [1, 2], and hence a concept of return on investment. Similar pressures are felt in transition economies in Africa [3] and among BRIC (Brazil, Russia, India, and China) countries [4]. Several analyses of financing of higher education in developing countries in the twenty-first century document a shift from state funding to private tuition from parents and students [5–8]. Tilak [9] notes that while public expenditure on higher education per student as a percentage of GDP fell between 1990 and 1991 and in 2006 across the world, the decline was −22% for South Asia, −38.5% for upper-middle-income countries, and −18.1% for high-income countries. For India, the number declined by 31%, from 92% to 61%.

However, post-2000, there has been an expansion in the higher education (HE) arena in India, mostly through private sector participation. Using Trow's [10] classification of elite, mass, and universal HE systems, India, with its gross enrollment rate of 21.1% in HEIs, is witnessing an initial massification of HE [11]. (According to Trow [10], elite systems are defined as those that enroll up to 15% between ages 18 and 23 years; mass systems as those enrolling between 15% and 40%; and universal systems as those enrolling more than 40%.) Despite the observation made by Tilak [9], post-2008, the Indian government transferred funds worth millions of rupees from state welfare schemes into private education in the form of self-financing courses run by public institutions, vouchers, and maintenance fee reimbursements [12]. As a result of this support by the public treasury, private sector participation in the HE sector increased. Several corporate-run philanthropic HEIs sprang up as well as private for-profit institutions. Inevitably, arguments based on market principles also began appearing in the literature, just as they did for developed economies [13].

For the most part, the academic debate on the entry of market forces into the HE sector is rooted in two opposing points of view: education as a public or a private good. Authors at both ends of the spectrum concede that education is a quasi-public good, since both nonexcludability and nonrivalry do not apply in the purest sense to education for it to

be called a pure public good [14]. Those arguing in favor of an increase in public funds for education tend to highlight the public interest aspect of education and the lower quality of education imparted by private institutions [13, 15], and pro-rich skewness in subsidy consumption in HEIs [16]. Some authors believe that privatization of public interest has already occurred in India but has not led to improvements in quality [15]. Authors rooted in the market tradition tend to view HE more from a private good perspective and point out the lack of accountability in public school systems, low levels of learning despite increased public spending and enrollment rates, and the cost-effectiveness of private schooling [17]. Since debate between private and public education is unsettled, Ndofirepi and Cross [3] argue that problems such as the low quality of knowledge production and inequality weighted in favor of the upper classes occur because of a shift away from a public good perspective of education, and the concurrent failure to recognize and thus legitimize the profit motive that has evidently crept into academe (Slaughter and Leslie [18], p. 210). The conclusion in Slaughter and Leslie suggests that the bulk of arguments are slanted more toward education as a public good, hence public funding, at least as far as transitioning economies are concerned. Against this backdrop of the public good vs. private good nature of education, Longden and Belanger [19] argue for a blended path that must embrace the marketplace while addressing responsibility and inclusion, and incorporating social justice. Crowley [20] recommends the Longden and Belanger path for teacher education.

We add to this debate in a novel way, thus, complementing the lines of argument above. We study the association between average quality of HEIs by state in India with the state's investment potential. To the extent the latter is designed to attract cash inflows in a pro-market economy, better quality of educational institutions in a state would imply better returns on investment ceteris paribus, hence, a high rank on investment potential. This link between quality HEIs and where the industry invests potentially is that for any industry, the availability of an educated and skilled workforce at competitive wages in a favorable labor environment is a significant factor affecting locational choice.

The relation between economic growth and quality of educational institutions is well established (Hanushek and Woessman [21] is a comprehensive reference). India, with an eye toward growth, is a perfect petri dish to study the link between investment potential and quality HEIs. It started liberalizing its economy in 1992 and deregulated several economic sectors to attract investment. First, it was the Central government that wanted private investment. In the last decade, states have stepped onto the world stage to directly compete for private investments. Do components of determinants of investment attractors impact the quality of HEIs, and/or do they interact with determinants of HEI quality to bring market-like efficiency to HEIs is a question that can be answered using Indian data. Moreover, there is a natural relationship between HEI quality and investment potential that the Indian data allow us to explore. The HEI quality data predate the investment potential indicators thus precluding reverse causality issues. So, even though the experimental setup is that of India, some broader implications can be drawn for the emerging market economies.

We fail to find evidence that the quality of a state's HEIs is directly associated (or mediates) with its investment potential. However, we find that the investment potential indicators do moderate this relation. These findings lead to two conclusions. One is more obvious that the current subindicators of quality of labor included in the metric used to measure investment potential (N-SIPI) are too restrictive and there is scope for expanding that set of subindicators. The other is less obvious. It is possible that the regulator of quality of HEIs while taking cognizance of a state's market attractiveness (reflected in N-SIPI, the indicator used in this study) infers there is only an indirect effect on quality of HEIs, and thus discounts pro-market tilt of a state in its direct assessments. If true, it can be inferred that the quality regulator approaches HE in India as a public not private good.

Several broad policy implications applicable to countries beyond India can be derived directly from this study. The findings indicate that even though an overt relation between HEI quality and investment potential is not evidenced in this study, yet there is a latent relation where infrastructure development indicator interacts with teaching and student learning outcomes to positively affect the quality of HEIs, even at the expense of research output. On the other hand, research output interacts significantly with the political governance of the state of location of HEI to increase its quality significantly. The evidence corroborates anecdotal evidence that political governance still plays a major role in research output of HEIs in liberalizing economies, and market economy indicators fail to impact it just yet.

The study contributes to the academic literature in at least two ways. One, the study shows that an overt link between investment potential comprising labor, economic, political, and infrastructure to quality of HEIs may be difficult to establish since the link is latent. And second, economies that are encouraging private money into their markets, may still have to rely on governmental schemes for HEIs since they interact with research output of HEIs to increase efficiency, but market economics indicators do not. Both these conclusions are relevant for emerging economies that are in the same boat as India.

The rest of the paper is organized as follows. Section 1 provides a brief context for the study, with emphasis on some of the key features of the Indian HE sector and regulatory set-up. Section 2 describes our data sources, data in detail, and our methodology. Section 3 outlines our results. Section 4 discusses the implications of these results in the larger context of the extant debate. Finally, Section 5 provides the conclusion and limitations of the study.

2. The Context

The University Grants Commission (UGC) at the central government level in 1956 was created to allocate resources

to HEIs, and to ensure the quality of HE. After India liberalized its economy in 1991 and undertook structural reforms, the UGC established an independent National Assessment and Accreditation Council (NAAC) in 1994 to monitor quality. The NAAC strives to make quality in education an integral part of all HEIs. The NAAC works on the basis of memorandums of understanding with state quality regulators, HE being a concurrent subject. This study employs quality indicators provided by the NAAC.

Simultaneously, autonomy of HEIs along the lines of IITs and IIMs is also sought by HEIs governed exclusively by the UGC rules. The autonomy–accountability dichotomy mirrors that of education as a private and a public good. The decision by the UGC to grant more autonomy to 60 institutions [22] is automatically interpreted to mean that these institutions shall have to raise finances privately [23], and thus follow the rules of the markets. In a milieu where the dilution of the allocative role of the regulator is compared to tailwinds in the sail of privatization and associated market rules, does HEI quality reflected in the NAAC's assessment correlated to the market indicators? This question is the subject of our study.

3. Data and Methodology

Data for this study come from two publicly available sources. The quality of HEI data is downloaded from the NAAC website. The "Analysis of accreditation reports" is downloadable from http://naac.gov.in/index.php/resources#analysis and available for 11 Indian states and the northeast region comprising seven smaller states. We use data contained in these reports in our study.

Over the years, the method of assessing and grading institutions by the NAAC has undergone evolutionary changes, beginning with the first method of percentile marking for 10 criteria, through the method of a percentile marking for seven criteria and an overall average score in percentage with a star grading system (A* to A*****), to the method used in the study, that of percentile marking for seven criteria, and an overall average score in percentage with a nine-point grading (C, C+, C++, B, B+, B++, A, A+, A++). For quantitative analysis, there is a marked difference in the scores under the star system and those in the nine-point grading system. The nine-point relative letter grading scale yields a composite score (much like a CGPA) without revealing scores on the individual criterion. However, the criterion-wise scores are available for clusters of institutions, which have undergone the process of assessment and accreditation under the NAAC.

We employ the criterion-wise scores, as a single composite score under the nine-point relative letter grade is not amenable to extracting a suitable metric concordant with market-based principles. A simple example will illustrate this point.

The single composite score of an HEI is a weighted average of seven criteria, with a convex weighting scheme where the weight of each criterion is greater than zero and the sum of weights adds up to 1. They are as follows: (1) curricular aspects, (2) teaching–learning and evaluation, (3) research, consultancy, and extension, (4) infrastructure and learning resources, (5) student support and progression, (6) organization and management, and (7) healthy practices (implying best practices in means and goals leading to quality education). Clearly, an institution that scores high on criterion 4 and low on criterion 3 may still obtain a higher composite score compared to another institution that scores low on criterion 3 but high on criterion 4. This is indeed the case when one compares Nabin Chandra College with Ram Krishna Nagar College in the northeast. (For Nabin Chandra College, the 7-tuple of scores on the seven criteria is (75, 75, 70, 60, 65, 65, and 70) with a weighted average of 70; the one for Ram Krishna Nagar College is (73, 75, 69, 74, 70, 72, and 69) for a weighted sum of 73.) As a ranking scheme, the weighted average does not differentiate based on the nature of each criterion, whereas an economic efficiency-based measure would recognize criterion 3 as an output of the system, and criterion 4 as an input. Such a market-based ranking system would not rank an HEI highly if it consumes many inputs for a low output. With a weighted score, such a counterintuitive economic ranking of the colleges named above is still possible. To avoid this anomaly, which is incompatible with the efficiency argument of market economics, we forego the use of composite scores for our study and instead employ the criterion-wise scores available for clusters of institutions assessed and accredited by the NAAC.

The set of financial indicators used for this study is drawn from another (independent of the NAAC) source, namely, the NCAER. The first report was released in 2016 and contains the NCAER state investment potential index (N-SIPI). The index, N-SIPI30, ranks 30 states based on four pillars (labor, infrastructure, economic climate, and political and governance indicators) and 44 subindicators. N-SIPI focuses on the policy and structural backdrop that determine the business environment in any state.

The construction of the N-SIPI30 is elaborate and takes into consideration several indicators. The labor indicator incorporates subindicators such as average wages, labor force participation rate, percent of youth (age 20–35 years) seeking/available for work, vocationally trained persons as % of total (15–64 years), above secondary level educated population as % of total (15–64 years), and the like. The last two subindicators along with number of ITIs are a proxy for quality of labor. Other indices are the infrastructure index, the economic factor, and the political and governance indicator. Finally, these four indicators are aggregated into a single indicator we call the overall N-SIPI30 index. The data for 2016 in this study are downloadable from http://www.ncaer.org/publication_details.php?pID=261.

The relationship of the NAAC quality indicators of HEIs to the N-SIPI30 is the relation we setout to examine in this paper.

The methodology we adopt to extract the economic efficiency index from the given NAAC criteria is data envelopment analysis (DEA). It has been applied extensively in study of efficiency of educational institutions (more recently, Xia et al. [24], apply the analysis to universities from different

regions in China). (Recently, Sharma and Sinawi [25] employ regression and ANOVA to study university quality in Malaysia.) Very briefly, it comprises the ratio of outputs-to-inputs of an individual decision-making unit (DMU, which in our case is the HEI or the cluster provided in the state-wise analysis of the NAAC accreditation reports) relative to a hypothetical frontier. DEA does not rely on an arbitrary probability distribution of outputs and inputs as do stochastic frontier analyses; hence, it is called a nonparametric method. We follow previous studies that use this methodology to study the economic efficiency of educational institutions. De Witte et al. [26] apply DEA to examine economies of scope in research and teaching. De Witte and López-Torres [27] compare different methodologies employed to study efficiency in education. They also point out that efficiency in education encompasses effectiveness and value for money. The author argues that "since the results of the education process are social constructs, there is always an effectiveness frontier, i.e., an acceptable level of the desired outcomes (e.g., quality, education attainments, equality of learning outcomes), which may be realized. Due to the social sensitivity of each education system, one should always bear in mind not only the simple link between what is invested in the system and the results of education, but also take care of the balance between the dimensions of efficiency and effectiveness in creating education policy [28]." To avoid a repetitive review, for the extant use of DEA scores in educational quality, refer to Thanassoulis et al. [29]. In Appendix, we define our inputs and outputs for DEA. (DEA has also found application outside of the academic literature on educational institutional efficiency, for example, in financial institutions literature though not so much in corporate finance. After the technique was formalized and popularized by Charnes et al. [30], Sherman and Gold [31] were the first ones to apply the technique to study efficiencies of bank branches in the US. This was followed by a more expansive study of bank by Rangan et al. [32] and Aly et al. [33] among others. The technique is now applied to banking systems in other economies too [34].)

After computing educational efficiency (EDU_EFF) for a DMU, we examine the pairwise correlations of the state average educational efficiency (SAVG_EDU_EFF) and the coefficient of variation of state educational efficiency (SCV_EDU_EFF) with the state's investment potential score (N-SIPI30). In order to test whether a state's investment potential mediates the relation between EDU_EFF and N-SIPI30, we run a multivariate linear regression of the form

$$(\text{EDU\_EFF})_i = a + B \cdot (X_i \times N\text{-SIPI}_s) + \text{Error}_i, \qquad (1)$$

where $(\text{EDU\_EFF})_i$ is the efficiency of DMU_i, obtained using DEA, a is a constant, B is the vector of coefficients for the explanatory variables, X_i is the NAAC criterion score vector for DMU_i of size (1×7), and $N\text{-SIPI}_s$ is the state "s" investment potential vector (1×4) containing scores for (labor, eco., infra., and political and governance) making the product $X_i \times N\text{-SIPI}_s$ and hence, B a vector of size (1×28). The error for DMU_i is assumed to be normally distributed. We estimate Equation (1) using heteroskedasticity-consistent clustered standard errors, clustered by state.

4. Results

We begin by describing the sample. From the 12 accreditation reports downloaded from the NAAC website, we are able to find 363 DMUs. We delete three DMUs from the state of Kerala since individual scores for these are not provided, and we also delete DMUs involved in teacher education since they are rated only on six criteria, not seven. As a result, our sample comprises 348 DMUs from 14 different states. The list of DMUs is provided in Table 1.

Table 1 shows the sample of institutions included in the study. Since the study employs data envelopment analysis (DEA) to assess efficiency, the institutions are called decision-making units (DMUs). They are taken directly from the reports of NAAC and thus exogenously defined. For full listing see reports on http://naac.gov.in/index.php/resources#analysis.

We use all 348 DMUs to estimate a global DEA frontier. Next, using the distance of each DMU from the efficient frontier, we estimate the educational efficiency of each DMU (EDU_EFF). The summary statistics of EDU_EFF for the overall sample and by state are presented in Table 2.

The highest efficiency units (EDU_EFF = 1) are observed in the states of Assam and West Bengal. Coincidentally, Assam DMUs are individual HEIs, while those for West Bengal are both individual HEIs and aggregate clusters formed for analysis by the assessment unit. The mass of individual HEIs present in the data from Assam increases the likelihood that a DMU will obtain a DEA efficiency score of 1. When clusters dominate data from a state, the average scores are reported, thus, reducing the likelihood of observing an efficiency score of 1. The highest average efficiency is observed for the state of Madhya Pradesh (0.85) and the lowest for the state of Haryana (0.77). Haryana also displays the lowest dispersion in efficiency scores, but there are only two DMUs from the state. Assam, which has the most units in the sample and the second highest mean efficiency scores, also has the highest dispersion in efficiency (0.076). The sample is weighted toward Assam. The national mean efficiency across the 348 DMUs is 0.83 with a deviation of 0.0659. The t-tests for differences in mean efficiency do not exhibit significant differences between Assam and Madhya Pradesh (t-stat $= -1.12$ with equal variances), Madhya Pradesh and West Bengal (t-stat $= 1.25$ with equal variances), and Assam and West Bengal (t-stat $= 1.10$ with unequal variances). Thus, for the largest three contributors to the sample by size, we fail to find a statistically significant difference in mean EDU_EFF.

Table 2 shows the summary statistics of the efficiency scores obtained using DEA and classified by state. The data for DEA are obtained from the NAAC reports.

As far as N-SIPI30 scores are concerned, in the NCAER report on state investment potential index, Delhi tops the list with a score of 47.5, followed by Gujarat at 47.2 based on the four pillars of scores (see page 166 of NCAER report, 2015).

Table 1: List of institutions used in the study.

DMU	Name of DMU	State
1	Karimganj College	Assam
2	Nabin Chandra College	Assam
3	Rabindrasadan Girl's College	Assam
4	Radhamadhab College	Assam
5	Ram Krishna Nagar College	Assam
6	Amuguri College, Dist. Sivasagar, Amuguri	Assam
7	Bahona College Jorhat, Assam	Assam
8	Bihpuria College, Dist. Lakhimpur, Bihpuria	Assam
9	D.H.S.K. Commerce College, Dibrugarh	Assam
10	Debraj Roy College, Golaghat	Assam
11	Demow College, Sivasagar	Assam
12	Deragaon Kamal Dowerah College, P.O. Deragaon	Assam
13	Devicharan Barua Girls College, Jorhat	Assam
14	Dibrugarh H.S.Kanoi College Jorhat	Assam
15	Digboi College, Digboi	Assam
16	Digboi Mahila Mahavidyalaya, Digboi	Assam
17	Furkating College, P.O. Furkating, Assam	Assam
18	Golaghat Commerce College, Golaghat	Assam
19	Hemo Prova Borbara Girls College, Golaghat	Assam
20	J.D.S.G. College, P.O. Bokakhat	Assam
21	Jagannath Barooah College, Jorhat, Assam	Assam
22	Janji Hemanth Sarmah college	Assam
23	Jorhat College (Amagamated), Mahathma Gandhi Road, Jorhat	Assam
24	Jorhat Kendriya Mahavidyalaya, Kenduguri, Jorhat	Assam
25	Joya Gogoi College, Khumati, Golaghat	Assam
26	Kakojan College, P.O. & T.O. Kakojan, Jorhat	Assam
27	Kamargaon College, Kamargaon	Assam
28	Lakhimpur Commerce College, North Lakhimpur	Assam
29	Lakhimpur Girls College, P.O. Khelmati, North Lakhimpur	Assam
30	Lakhimpur Kendriya Mahavidyalaya, Dist. Lakhimpur, P.O. Charaimoria	Assam
31	Mahadev College, Narayanpur, Dist. Lakhimpur	Assam
32	Margherita College, Margherita, Assam	Assam
33	Namrup College, Dibrugarh	Assam
34	Nandanath Saikia College, Jorhat District, Assam	Assam
35	North Lakhimpur College	Assam
36	S.M.D. College, Dist. Sivasagar Charing	Assam
37	Saruoathar College Dist. Golaghat P.O. Sarupthat	Assam
38	Science College, Joysagar	Assam
39	Sibsagar College, Joysagar	Assam
40	Sibsagar Girls College, Dist. Sivasagar	Assam
41	Sonari College, Dist. Sivasagar	Assam
42	Swahid Peoli Phukan College, Dist. Sivasagar	Assam
43	The Gargon College, Simaluguri	Assam
44	The Sibsagar Commerce College, Sivasagar	Assam
45	Tinsukia College, Tinsukia	Assam
46	Women's College, Tinsukia	Assam
47	B.H. College, Barpet	Assam
48	Balaji College, Barpeta	Assam
49	Bijni College, Dist. Bonagaigaon, Bijni	Assam
50	Bikali College, Goalpara	Assam
51	Birjhora Mahavidyalaya, Bongaigaon	Assam
52	Biswanath College, P.O. Chariali, Sonitpur	Assam

(*continued*)

Table 1: Continued.

DMU	Name of DMU	State
53	Bongaigaon College, Bongaigaon	Assam
54	Chaiduar College, Dist. Sonitpur, Gohpur	Assam
55	Cotton College, Guwahati, Assam	Assam
56	Dakshin Kamrup College, P.O. Mirza, Kamrup	Assam
57	Darrong College, Tezpur, Assam	Assam
58	Dispur College Ganeshguri, Dispur, Guwahati	Assam
59	Dudhnoi College, Goalapara, Assam	Assam
60	Goreswar College, Dist. Kamrup, Goreswar	Assam
61	Gossagaon College, Dist. Kokrajhar, Gossagaon	Assam
62	Handique Girls' College, Guwahati, Assam	Assam
63	Jagiroad College, Dist. Morigaon, P.O. Jagiroad	Assam
64	Janata College, Dist. Kokrajhar, P.O. Serfanguri	Assam
65	Kokrajhar College, Kokrajhar	Assam
66	Lalit Chandra Bharali College, Guwahati, Assam	Assam
67	Madhab Choudhury College, Barpeta, Assam	Assam
68	Mahendra Narayan Chodhury Balika Mahavidyalaya, Nalbari	Assam
69	Mangaldai College, Dist. Darrang, Mangaldai	Assam
70	Morigaon College, P.O. Moriaon	Assam
71	Nabajyoti College, Kalgachia, Assam	Assam
72	Nalbari College, Nalbari, Assam	Assam
73	Nalbari Commerce College, Dist. Nalbari, P.O. Chowkbazar	Assam
74	North Gauhati College, P.O. College Nagar, Guwahati	Assam
75	Pandu College, Guwahati, Assam	Assam
76	Paschim Guwahati Mahavidyalaya, P.O., Dharapur, Guwahati	Assam
77	Pragjyotish College, Guwahati, Assam	Assam
78	Pub-Kamrup College	Assam
79	Sonapur College, P.O. Sonapur, Kamrup	Assam
80	Tezpur College, Dist. Sonitpur, Tezpur	Assam
81	Tihu College, Tihu, Assam	Assam
82	Tyagbir Hem Baruah College, P.O. Jamguri Hat, Sonitpur	Assam
83	Udalguri College, Udalguri, Darrang	Assam
84	Aizwal West College, Dawrpui Vengthar, Aizwal	Mizoram
85	Govt. Aizwal College, Sikulpuikawn, Aizwal	Mizoram
86	Govt. Chaphai College, Chaphai	Mizoram
87	Patkai Christian College, Seithekiema, Chumukedima	Nagaland
88	Shillong Collge, Shillong, Meghalaya	Meghalaya
89	St. Antony's College, Shillong, Meghalaya	Meghalaya
90	St. Edmund's College, Shillong, Meghalaya	Meghalaya
91	Belonia College, Belonia	Tripura
92	Maharaja Bir Bikram College, P.O. Agarthla College, Agarthala	Tripura
93	Ramakrishna Mahavidyalaya, Kailashahar	Tripura
94	Women's College, B.K. Road, Agarthala	Tripura
95	Abhayapuri College, P.O.Abhayapuri	Assam
96	Anandaram Dhekial Nagaon Phookan College	Assam
97	B.B.K. College, Nagaon	Assam
98	B.H.B. College, Sarupeta P.O.	Assam
	…	
	…	
	…	
327	Deemed universities	Maharashtra
328	Professional colleges	Maharashtra
329	University of Mumbai	Maharashtra

(*continued*)

Table 1: Continued.

DMU	Name of DMU	State
330	University of Pune	Maharashtra
331	Shuvaji University, Kolhapur	Maharashtra
332	Nagpur University	Maharashtra
333	Dr. Ambedakr Unviersity, Aurangabad	Maharashtra
334	North Maharashtra University, Jalgaon	Maharashtra
335	Swami Ramanand Teerth University, Nanded	Maharashtra
336	SNDT Womens University, Mumbai	Maharashtra
337	Amravati University	Maharashtra
338	Private affiliated mean	Tamil Nadu
339	Private autonomous mean	Tamil Nadu
340	Government affiliated	Tamil Nadu
341	Government autonomous	Tamil Nadu
342	Women private autonomous mean	Tamil Nadu
343	Women private affiliated mean	Tamil Nadu
344	Women government autonomous	Tamil Nadu
345	Women government affiliated	Tamil Nadu
346	Teachers Ed private autonomous mean	Tamil Nadu
347	Teachers Ed private affiliated mean	Tamil Nadu
348	Teachers Ed government autonomous	Tamil Nadu

Table 2: Summary statistics of efficiency scores.

State	N	Mean	Std. dev.	Minimum	Maximum
Andhra Pradesh	20	0.804	0.0375	0.7502	0.8867
Assam	145	0.8378	0.076	0.6551	1
Haryana	2	0.771	0.0142	0.761	0.781
Karnataka	10	0.8108	0.0673	0.752	0.99
Madhya Pradesh	49	0.8508	0.048	0.7571	0.9529
Maharashtra	11	0.8022	0.0201	0.7826	0.8452
Meghalaya	4	0.8151	0.0342	0.7871	0.8612
Mizoram	3	0.8395	0.0178	0.8193	0.8529
Nagaland	1	0.8167		0.8167	0.8167
Punjab	26	0.7833	0.0621	0.6515	0.9316
Rajasthan	8	0.8433	0.0791	0.7032	0.9475
Tamil Nadu	11	0.8267	0.0274	0.7918	0.8887
Tripura	4	0.8284	0.0337	0.8041	0.8768
West Bengal	54	0.8368	0.0635	0.7009	1
Overall	348	0.8306	0.0659	0.6515	1

Since, out of the 30 states in the NCAER report, data for only 14 matching states are available in the NAAC database, we reproduce the scores for those 14 states in Table 3 for the sake of completion and provide the summary statistics. Note that higher scores imply better market potential in that state.

Table 3 shows the individual financial indicator scores as well as the summary statistics of the 14 states to which the DMUs belong. The overall score of N-SIPI30 comprises scores on labor, infrastructure, economic, and political governance indicators. All scores are provided in the NCAER report, only the summary statistics are authors' own calculations.

In order to test if the market attractiveness indicators of N-SIPI30 correlate with the NAAC measures of efficiency, we undertake a pairwise Pearson correlation examination. Since market indicators are available for 14 states, we take the mean EDU_EFF by state to test for the correlation. None of the correlation coefficients are statistically significant. The results are provided in Table 4.

Table 4 provides pairwise correlations between mean efficiency score by states and the financial indicators across the 14 states. Numbers below the correlation values represent the p-values. The ones that are significantly different from zero are in bold. Note that the mean efficiency score displays no significant correlation with any of the financial indicators. Data for efficiency are obtained from the NAAC and data for financial indicators from the NCAER.

After finding an absence of correlation in Table 4, we examine whether the coefficient of variation (CV) of EDU_EFF is related to the investment potential of a state. Given that state governments vary by state, and states control most of the quality measures used by the NAAC in their assessment of HEIs, it is likely that some states with a lower degree of market orientation may differ in their approach to quality than those that are more market-oriented. State governments that are more egalitarian in their approach to governance than those that are more laissez-faire, may strive for a more centralized approach to education that may not be oriented toward efficiency-based outcomes. Such practices may be reflected in the CV measure of EDU_EFF. Hence, we run a Pearson correlation analysis of N-SIPI30 with the CV of EDU_EFF. The results are presented in Table 5. Needless to add, since most variables are the same as in Table 4, the correlations are also the same. However, the first column correlations are different from Table 4. We find that the CV

Table 3: Summary statistics of four subindicators of N-SIPI30 scores.

State	Laborscore_SIPI30	Infrascore_SIPI30	Econscore_SIPI30	PolGovscore_SIPI30	Overallscore_N-SIPI30
Andhra Pradesh	45.8	27.1	45	52.9	41.5
Assam	30.5	30.5	34	42.8	34.1
Haryana	23.7	31.6	33.3	57.2	34.6
Karnataka	50.5	29.6	37.9	56.6	42.3
Madhya Pradesh	35.9	24.4	34	62.3	36.9
Maharashtra	45	35.2	43.7	49.8	43.1
Meghalaya	34.3	17.5	30	54	31.4
Mizoram	30.1	23.6	21.2	71.4	32.2
Nagaland	43.7	23.5	18.5	68.5	33.7
Punjab	38.6	36.3	26.2	51.6	37.1
Rajasthan	44.1	22	36.2	51.1	36.6
Tamil Nadu	56.3	32.7	39.9	64	46.6
Tripura	40.9	22.3	25.7	72.6	36.1
West Bengal	43.1	38.6	26.1	48.5	38.1
Mean	40.2	28.2	32.3	57.4	37.5
Std	8.4	6	7.7	8.8	4.3
Min	23.7	17.5	18.5	42.8	31.4
Max	56.3	38.6	45	72.6	46.6

Table 4: Correlations between mean efficiency scores by state and financial indicators.

	Efficiency_Mean	Laborscore_SIPI30	Infrascore_SIPI30	Econscore_SIPI30	PolGovscore_SIPI30	Overallscore_N-SIPI30
Efficiency_Mean	1					
Laborscore_SIPI30	0.13971 0.6338	1				
Infrascore_SIPI30	−0.35481 0.2132	0.19019 0.5149	1			
Econscore_SIPI30	−0.15577 0.5949	0.38044 0.1796	0.22964 0.4297	1		
G_Pscore_SIPI30	0.16607 0.5704	0.04604 0.8758	−0.46406 **0.0946**	−0.47358 **0.0872**	1	
Overallscore_N-SIPI30	−0.1142 0.6975	0.80311 **0.0005**	0.53002 **0.0512**	0.7122 **0.0043**	−0.13594 0.6431	1

Table 5: Correlations between CV of efficiency scores by state and financial indicators.

	Efficiency_CV	Laborscore_SIPI30	Infrascore_SIPI30	Econscore_SIPI30	PolGovscore_SIPI30	Overallscore_N-SIPI30
Efficiency_CV	1					
Laborscore_SIPI30	0.19662 0.5197	1				
Infrascore_SIPI30	0.11985 0.6965	0.19019 0.5149	1			
Econscore_SIPI30	−0.01927 0.9502	0.38044 0.1796	0.22964 0.4297	1		
G_Pscore_SIPI30	−0.5655 **0.044**	0.04604 0.8758	−0.46406 **0.0946**	−0.47358 **0.0872**	1	
Overallscore_N-SIPI30	−0.02221 0.9426	0.80311 **0.0005**	0.53002 **0.0512**	0.7122 **0.0043**	−0.13594 0.6431	1

Table 6: Results of multivariate regression.

Variable	Parameter estimate	Standard error	*t*-value	Pr > |*t*|
Intercept	0.84862	0.0218	**38.93**	**<.0001**
Crit1_Labor	−0.00018	0.00012	−1.53	0.1277
Crit2_Labor	−0.00027	0.00013	**−2.14**	**0.033**
Crit3_Labor	−0.00005	0.00005	−1.02	0.309
Crit4_Labor	0.00018	0.00007	**2.7**	**0.007**
Crit5_Labor	0.00009	0.00011	0.77	0.4411
Crit6_Labor	0.0003	0.00005	**6.06**	**<.0001**
Crit7_Labor	−0.00008	0.0001	−0.83	0.4084
Crit1_Infra	−0.00006	0.0001	−0.66	0.5076
Crit2_Infra	0.0004	0.0001	**4.29**	**<.0001**
Crit3_Infra	−0.00008	0.00004	**−2.16**	**0.032**
Crit4_Infra	−0.00025	0.00006	**−4.05**	**<.0001**
Crit5_Infra	−0.00005	0.00009	−0.6	0.5463
Crit6_Infra	−0.00013	0.00006	**−2.31**	**0.022**
Crit7_Infra	0.00016	0.00008	**2.11**	**0.035**
Crit1_Econ	0.00006	0.00008	0.7	0.4825
Crit2_Econ	−0.00003	0.00007	−0.33	0.7401
Crit3_Econ	−0.00004	0.00004	−1.07	0.287
Crit4_Econ	0.00016	0.00005	**3.73**	**2E-04**
Crit5_Econ	−0.00018	0.00008	**−2.46**	**0.014**
Crit6_Econ	−1.00E-05	0.00005	0	0.9986
Crit7_Econ	0.00003	0.00007	0.31	0.7601
Crit1_PolGov	0.00012	0.00008	1.56	0.1189
Crit2_PolGov	0.00011	0.00009	1.24	0.2174
Crit3_PolGov	0.00017	0.00004	**4.11**	**<.0001**
Crit4_PolGov	−0.00013	0.00003	**−4.06**	**<.0001**
Crit5_PolGov	−0.00002	0.00007	−0.16	0.8699
Crit6_PolGov	−0.00018	0.00004	**−5.77**	**<.0001**
Crit7_PolGov	−0.00008	0.00007	−1.16	0.2472
N	348			
R-square	0.7119			
Adj. *R*-square	0.6866			

of EDU_EFF is negatively and significantly correlated with the political stability and governance score of the state. Thus, states that have a governance structure positively impacting the state's competitiveness potential for investments tend to have a negative correlation with the spread of EDU_EFF. The evidence suggests more homogenization of efficiency scores in states with better political stability and governance. Since CV measures the quantity of risk in a distribution normalized for its expected value, the finding implies that in states with higher political stability and better governance, when a student chooses a particular HEI, there is less uncertainty about the HEI's quality compared to a similarly efficient HEI in another state with less political stability and poorer governance.

Table 5 provides pairwise correlations between coefficient of variation (CV) of efficiency scores by state and the financial indicators across the 14 states. Numbers below the correlation values represent the *p*-values. The ones that are significantly different from zero are in bold. Note that the CV of efficiency scores displays a significant correlation with only the political governance of a state, signifying the spread in efficiency scores is smaller if the political governance score is higher, thus, evidencing lower inequality among DMUs of a state. Data for efficiency are obtained from the NAAC and data for financial indicators from the NCAER.

The results in Tables 4 and 5, taken together, fail to provide evidence that the NAAC quality measures (in efficiency terms) are mediated by a state's investment potential metrics. But does that imply that the NAAC quality assessment is sequestered from a state's market attractiveness?

To answer the question above, we interact the NAAC criterion scores with a state's N-SIPI30 component scores to form the covariates that could possibly affect the efficiency score of an HEI. The results of the estimation of Equation (1) are presented in Table 6.

The result of the multivariate regression shows that the interacted N-SIPI30 scores with different NAAC criteria do affect the efficiency scores. There is statistical significance in both the model and the coefficients of regression. The adjusted *R*-square is 0.68, evidencing the model explains

68% of the variation in EDU_EFF. The evidence suggests that factors that measure the investment potential of a state and signal its market attractiveness moderate the NAAC quality scores as well.

Table 6 shows the results of pooled multivariate regression of efficiency scores against the interaction terms where the interaction is between the individual DMU's score on each criterion with the state's four financial indicators: labor, infrastructure, economic, and political governance (Equation (1)). The *t*-stat is computed using heteroskedasticity-consistent clustered standard errors. The significant slope coefficients are in bold. The last column provides the *p*-values. Data for efficiency are obtained from the NAAC and data for financial indicators from the NCAER.

5. Discussion

Tooley [35], based on his prior work and review of the literature, writes that studies of the phenomenon of low-cost private schools "mushrooming" in poor areas of sub-Saharan Africa and South Asia show that these schools are serving a majority (urban and periurban) or a significant minority (rural) of the poor, including significant proportions of the poorest of the poor. However, on the quality front, private sector involvement in India does not appear to have improved quality despite significant cost efficiencies in the private sector [36].

In the HE education sector, Lambert [37] advocates public–private partnerships in the sector with clearly defined public goals that even private players should achieve. This view has also found resonance in developing countries such as India, where the target of achieving education for all at the high school level has created a demand for college-level education; hence, private participation has become a necessity for the HE sector. The larger question is whether the social justice objective that the HE sector in India, through its emphasis on public good it aims to espouse, will be preserved in a private dispensation.

It is against this backdrop that the results of this study must be understood. Given that India is moving up in ease of doing business in World Bank rankings, it is valid to inquire if the policymakers in education (the HE sector in our study) have already begun representing private sector interests. The results show there is no indication that the Indian quality regulator is influenced by the market principles. A state's potential attractiveness for investors has no bearing on how quality regulators in the HE sector rate its HEIs.

6. Conclusion and Limitations

In this paper, we setout to examine if the higher education sector in India, which is a developing economy transitioning from a centrally planned to a market-based economy, shows signs of marketization in its evaluations and assessments. We find that a broad-based index that captures a state's investment potential shows no correlation with the quality indicator of its HEIs as assessed by the national regulator. Despite concerns of marketization and the fear that the quality regulator NAAC will diminish public interest and promote private interests, the public data used in the study failed to establish that these concerns have an empirical basis. The public good nature of higher education appears to be holding in a changing India.

The findings also indicate that there is a latent relation where infrastructure development indicator interacts with teaching and student learning outcomes to positively affect the quality of HEIs, while research output interacts significantly with the political governance of the state of HEI to increase its quality significantly. The evidence corroborates anecdotal evidence that political governance in conjunction with research output of HEIs improves efficiency, while market economy indicators fail to interact with research output to have a significant impact on efficiency.

The study invokes an economic measure of efficiency on data primarily used to assess the quality of HEIs in India by the NAAC, by dividing the ratings criteria into inputs and outputs. We avoided getting mired in the debate as to whether this is a suitable metric and instead relied on previous work [29] that have used efficiency metric in educational quality. The fact that the inputs and outputs were scalar scores rather than rupee amounts also helped us in utilizing efficiency scores as a quality metric. Similarly, the state investment potential dataset is used as a proxy for market attractiveness and the extent to which market principles hold and market players exert power in a state. Finally, even though the datasets are independently constructed, one could always contend that the evidence provided in the paper is only indirect. But, that is always true for any study of this kind.

Appendix

Data Envelopment Analysis (DEA)

We employ the output-oriented DEA. The scores for criterion 2 and criterion 3, namely, teaching–learning and evaluation, and research–consultancy and extension, respectively, are treated as outputs, and criteria 1, 4, 5, 6, and 7 are considered as input factors. To reiterate from the main text, the seven criteria are (1) curricular aspects, (2) teaching–learning and evaluation, (3) research, consultancy, and extension, (4) infrastructure and learning resources, (5) student support and progression, (6) organization and management, and (7) healthy practices (implying best practices in means and goals leading to quality education). Formulaic exposition is available upon request.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares that there is no conflicts of interest.

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