Funding and University Performance: An Econometric Analysis of the Indian Public Universities

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ABSTRACT

Underpinning the aim of India's National Education Policy, 2020 to devise a performance-based funding mechanism, it is pertinent to examine the impact of existing financial support on the university's performance. Using a fixed panel data analysis, the present study investigates the influence of funding on the performance of Indian public universities over the period 2016-2020. The funding is considered in terms of the plan and non-plan grants received by universities from the central government, while performance is measured using performance parameters given by National Institutional Ranking Framework, 2021. Controlling the age, size and ownership type of university, findings reveal a significantly positive impact of funding on teaching performance, research performance and graduation outcomes of government-owned universities. Surprisingly, university's outreach, inclusivity and peer perception have been observed to be indifferent towards central grants. Overall, the study provides valuable insights to university practitioners and policymakers for future development of the performance-funding mechanism.

Introduction

In the pursuit of achieving equity, efficiency and global excellence in the higher education sector, universities from all around the world are striving to enhance their institutional performance (Chattopadhyay, 2020). As an upshot, governments of several nations are focusing on designing such policies, practices and regulatory frameworks which enable their universities to be on the list of 'world-class institutions' (Nassa et al., 2021). Many Asian countries like Hong Kong, Japan, Korea, Singapore and Taiwan have developed various performance parameters and have linked state-funding schemes with them to improve the excellence of their universities (Hou, 2012; Mok, 2003; Yi et al., 2015). The National Education Policy (NEP), 2020 released by the Ministry of Education (MoE) of India is also one of the revolutionary policies which plan to design a performance-based funding mechanism for developing superlative universities in India (NEP, 2020). Primarily, this mechanism guides the government to allocate grants to higher educational institutions (HEIs) based on the results of their performance indicators. If universities do not perform as expected, these pre-designed performance indices can help funding agencies to examine the effects of their financial aid on performance and thus, future budget allocation can be decided (Azma, 2010). Therefore, it is imperative to analyze the fund's utilization by universities for assessing their soundness, financial sustainability and overall performance.

Despite the availability of funding-performance literature in many American and European countries, little research has been conducted on it in the context of the Indian public universities (IPUs). This is because a performance-based funding mechanism is yet to be implemented within HEIs of India. Based on this literature gap, the present research studies the impact of funding from the central government on the performance of IPUs. Whether a university's funding affects its performance is investigated based on the concept of educational production function (EPF) (Lee & Kim, 2019). The EPF perspective is grounded in the theoretical assumption that investment in educational entities results in better productivity and better performance (Abbott & Doucouliagos, 2004; Belfield & Fielding, 1999). Therefore, the universities which receive financial support from the government are usually expected to perform better.

To discern the impact of central funding (CF) on university performance, the study employs a panel data regression analysis using a sample of 57 public universities over the five years, from 2016 to 2020. Alike other countries, the Ministry of Education (MoE) of India has its own National Institutional Ranking Framework (NIRF) for ranking its institutions based on their five performance parameters, i.e., Teaching, Learning and Resources (TLR), Research and Professional Practices (RPP), Graduation Outcomes (GO), Outreach and Inclusivity (OI) and Peer Perception (PP). The annual scores of all these indicators have been used as the dependent variable for quantifying the performance of a public university. Further, CF has been measured as the total of plan and non-plan grants received annually by universities from the central funding agency, i.e., the University Grants Commission (UGC) of India. This analysis is anticipated to provide valuable insights to the academicians, policymakers and practitioners in two aspects. First, the results can guide policymakers on effective performance parameters which could be used while devising performance-based funding policy. Second, it can aid university practitioners in strategic decision-making for reinforcing the efficiency and effectiveness of their teaching, research and financial performance.

The remainder of the article proceeds as follows: Section 2 reviews the literature on university performance and its relation to funding and presents the hypotheses of the study. Then, Section 3 discusses the research methodology including the empirical model. After describing the results and findings of the study in Section 4, the paper finally concludes with implications, some limitations and the future scope of the research.

Literature Review and Research Hypotheses

University Performance

As defined by El Talla et al. (2018), performance is the outcome of numerous activities performed with vari-

ous tangible and intangible resources, which reflects the institution's success, sustainability and environmental flexibility. For measuring a university's performance, extant literature documents two different approaches, i.e., the Conventional or single-dimensional performance measurement approach (Ball & Halwachi, 1987; Wang, 2010) and the Value-added or multi-dimensional performance measurement approach (Johnes, 2016; Johnes & Taylor, 1990; Wang, 2010).

Developed in the 1980s, the conventional approach interprets a university's performance in terms of efficiency and effectiveness of actions performed, wherein efficiency is conceptualized as the simple input-output ratio, e.g., cost per student, number of research paper publications per faculty, etc. (Carmona & Sieh, 2004; Johnes, 1992). Based on this approach, many researchers (e.g., Ball & Halwachi, 1987; Hattie, 1990; Higgins, 1989; among others) had given models of performance indicators for HEIs to determine input-output efficiency and ranking of such institutions using efficiency scores. However, recent literature has empirically validated that a mere ratio analysis cannot capture the overall performance of universities, since these institutions offer multiple products and every institution uses the varying level of inputs (Barnett, 1992; Johnes, 1992; Taylor, 2001).

Therefore, due to the limitations of the single-dimension approach, some of the authors had ensued value-added approach which considers multi-dimensional perspectives for measuring a university's performance (Barnett, 1992; Cave et al., 1997; Johnes, 1992, 2016; Wang, 2010). Unlike the conventional approach, it considers sophisticated measures based on financial perspective, customer perspective, internal business perspective and learning and growth perspective (Johnes, 2016; Kaplan & Norton, 1992; Wang, 2010). In 2004, Badri and Abdullah operationalized the performance of a university faculty in terms of teaching, research, institutional and community service. Using a case study of United Arab Emirates University, the authors developed an analytic hierarchy process (AHP) model for performance evaluation and ranking of faculty members. Following this study, Azma (2010), Chen et al. (2009), Suryadi (2007), and Wang (2010) developed different performance indices for HEIs of various countries all around the world. AHP was also used in another study by Asif & Searcy (2014) in which a

composite index was developed based on the extensive literature review of various teaching performance indicators, research performance indicators, service performance and financial performance indicators. More recently, Bunting (2020) studied various dimensions of performance of South African public universities, wherein annual financial statements of 23 universities were examined for ten financial years from 2007 to 2016. The findings of this study gave 24 non-profit financial indicators and three foundational models for measuring the efficiency of educational institutions.

Along with academicians, several national and international ranking institutions have been seen framing various university ranking frameworks for comparing the educational quality of different universities using comprehensive parameters. The Academic Ranking of World University by Shanghai Jiao Tong Institute, Atal Ranking of Institutions on Innovation Achievements (ARIIA), National Institutional Ranking Framework (NIRF), India, QS Times Higher Education (THE) World University Ranking are some of the renowned ranking parameters which issue annual ranking based on their frameworks. Many empirical studies are now further using such pre-defined ranking parameters for quantifying university performance. For example, Nassa et al. (2021) measured the research performance of engineering institutions in India using the Research and Professional Practices (RPP) parameter given by NIRF. Following the literature, the present research uses NIRF parameters for operationalizing the overall performance of the Indian public universities.

Funding and Performance

With the attention of academicians and policymakers toward effective utilization of public funds, many studies have been found to establish a link between university funding and performance (e.g., Bloch et al., 2014; Doh et al., 2018; Gulbrandsen & Smeby, 2005; Hillman et al., 2014; Lee & Kim, 2019; Sanford & Hunter, 2011; Shin, 2010; Tochkov et al., 2012; Yi et al., 2015; among others). Over the period 2002-2019, empirical evidence from countries like Finland, Germany, Korea, Norway, Tennessee, and the United States suggest that HEIs receiving government funding perform better in terms of research performance (Bloch et al., 2014; Doh et al.,

2018; Gulbrandsen & Smeby, 2005; Liefner, 2003), students' outcome (Lee & Kim, 2019) and overall institutional performance (Dougherty & Reddy, 2011; Yi et al., 2015). These studies have attributed enhanced university performance to the fact that financial aid develops more accountability among educational institutions, which results in improved management, research as well as student practices (Colclough & De, 2010; Kapoor & Arya, 2019; Yi et al., 2015). Contrarily, many authors have reported modest to little impact of funding on specific performance outcomes of universities. For example, Shin (2010) used the panel data from the year 1997 to 2007 to analyze the impact of central financial support on the performance of US universities. Considering research productivity and graduation rates as the dependent variable, the study did not find any significant effect of financial support on performance. Similarly, Sanford & Hunter (2011) and Hillman et al. (2014) also examined the effect of financial incentives on HEI's employment rate and graduation rate and found the academic performance measures to be unrelated to grants provided by the state and central government.

Thus, due to the conflicting findings in international literature, it is interesting to analyze the impact of central funding on the performance of the Indian public universities as well. Since NEP, 2020 is devising the performance-based funding mechanism within Indian universities, this further adds more relevance to the study. Earlier, most of the Indian literature in this context is purely descriptive in nature. In India, there is one example by Nassa et al. (2021) which specifically observed the impact of university ranking on the 'Research and Professional Practices (RPP)' parameter developed by NIRF, India. Hence addressing this literature gap, the present study tests the following two-tailed hypotheses for examining the funding-performance nexus based on all five NIRF performance parameters:

H_1= The funding from the central government significantly influences the teaching and learning resources (TLR) of the public universities.

H_2= The funding from the central government significantly influences the research and professional practices (RPP) of the public universities.

H_3= The funding from the central government significantly influences the graduation outcomes (GO) of the public universities.

H_4= The funding from the central government significantly influences the outreach and inclusivity (OI) of the public universities.

H_5= The funding from the central government significantly influences the peer perception (PP) of the public universities.

Research Methodology

Sample Selection and Data Sources

The study constructed a strongly balanced panel dataset of 57 universities spanning over five years from 2016 to 2020. Initially, the sample was a subset of the top 100 universities ranked under the 'university' category by the India Rankings report, 2021 based on NIRF. Out of 100 universities, a total of 14 private universities, privately-funded deemed universities and institutes of national importance were firstly excluded from the sample, since the study considers only government-owned higher educational institutions. Then, 11 public universities for which performance data was not available for all five consecutive years were deleted from the sample. Among the resulting 75 universities, 18 universities did not receive funding from the central government consecutively during the study period, hence those were also dropped from the sample. The final sample, therefore, included 12 central universities, 12 deemed to be universities and 33 state universities, accounting for 285 university-year observations. Annexure 1 summarizes the sample selection criteria.

The secondary data required for all variables were retrieved from two major data sources. To measure the performance of universities, India Rankings reports were accessed from the year 2017 to 2021. The India Ranking reports are released on annual basis by the Ministry of Human Resource Development (MHRD), Government of India based on the information submitted by institutions for the previous year. Further, data related to funding by the central government was collected from the annual reports issued by the UGC from year 2016 to 2020.

Variables

Independent Variable

In the study, central funding (CF) was taken as an independent variable, which was measured as the total financial assistance provided by the central government of India to each central, state and deemed-to-be-university. The central government gives financial assistance to various educational institutions through a regulatory and statutory body, namely, University Grants Commission (UGC). Primarily, UGC issues funds to universities in terms of the General Development Grants (GDGs) and Maintenance Grants (MGs). The GDGs are received by all the eligible central, state and deemed universities to ensure their development for activities like increasing access to education, ensuring equity, quality and excellence in imparting relevant education, ensuring effective university administration, augmenting infrastructural facilities, improving quality of research and other such plans of universities. However, MGs are provided to only central and deemed universities for meeting their recurring expenditure (e.g., salaries of teaching and non-teaching employees, expenditure for maintenance of university libraries, labs, buildings, etc.). Thus, the central universities and deemed universities receive both capital and revenue (including recurring and non-recurring expenditure) grants (i.e., GDGs and MGs) while the state universities are paid only capital grants (i.e., GDGs) (UGC Annual Report, 2018-19). For the study, CF included the total grants, i.e., both capital and revenue grants paid to a university.

Dependent Variable

The dependent variable, i.e., university performance (PERF) was quantified in terms of the performance scores calculated based on five ranking parameters provided by NIRF. These parameters include, (i) Teaching, Learning and Resources (TLR), (ii) Research and Professional Practice (RPP), (iii) Graduation Outcomes (GO), (iv) Outreach and Inclusivity (OI), and (v) Peer Perception (PP). Annexure 2 gives a detailed description of each of these parameters along with the weightage assigned to various sub-parameters used for calculating scores under these five broad heads. In each category, an overall score can have a maximum value of 100, where a higher value would represent better PERF, and vice-versa.

Control Variables

To control the effect of institutional characteristics on the funding-performance association, the paper included three control variables based on the review of existing literature. Following Yi et al. (2015), a natural logarithm of the strength of UG, PG and PhD students in a particular year was used for controlling the size (SIZE) of a university. Then, to account for the differences in the experience of various universities, age (AGE) of the university was entered into the regression equation as a covariate. AGE was included as a natural logarithm of the number of years since the university's establishment. Further, many researchers have highlighted the importance of controlling the type of ownership of an institution (Lee & Kim, 2019; Yi et al., 2015). Therefore, institutional ownership (IOWN) was also controlled by considering ownership as a dummy variable with a value of 1 for each type of university.

The summarized description of all variables included in the study is given in Annexure 3.

Empirical approach

The paper employed a fixed panel data[1] regression model for analyzing the impact of central funding on university performance. Since PERF was measured in terms of TLR, RPP, GO, OI and PP, a separate regression model was run for each performance parameter. Following Lee & Kim (2019), an analytical model used for the multivariate analysis is given as equation 1:

$$PERF_{it} = \alpha + \beta_1\,(CF_{it}) + \beta_2\,(Control\;Variables_{it}) + e_{it} \qquad \text{Eq. (1)}$$

where,

$PERF_{it}$ = Performance of a university i in the year t, measured in terms of TLR, RPP, GO, OI and PP;

CF_{it} = Total sum of revenue and capital grants issued by UGC to a University i in the year t;

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[1] Fixed panel data is the data set in which same entities (or individuals) are observed in each period (Greene, 2008).

Control Variables = SIZE, AGE and IOWN

e_{it} = error term

To run a panel data regression model, the Redundant Fixed Effect Tests (F-test)- Likelihood Ratio test was used for choosing between the pooled OLS regression model and Least Squares Dummy Variable LSDV model, i.e., the fixed-effect model. The Redundant Fixed Effect Tests assume the fixed-effect model to be redundant suggesting the absence of both period and cross-sectional effect (Gill & Kaur, 2015). In the present study, *p*-values of the F-test for each performance parameter were found to be less than 0.05, strongly supporting the alternative hypothesis that the fixed effect model gives better goodness-of-fit values as compared to the pooled OLS regression model (Park, 2011). Further, the Hausman specification test was applied for comparing the suitability of the fixed-effect regression model and random-effect regression model in each case. The *p*-values of chi-square were also found to be less than 0.05 for TLR, RPP, OI and PP as a performance variable, therefore in each case, the null hypothesis was not supported. This indicated the suitability of the fixed-effect model over the random-effect model for all parameters of PERF, except for GO. Since only the secondary data sources (i.e., UGC annual reports and India Ranking reports) were used in the study, no outliers were observed. The data was found to be homoscedastic for all performance parameters except the RPP variable. For that purpose, Huber-White-Sandwich Estimator for variance was put

into the fixed-effect regression model for controlling the presence of heteroskedasticity. In addition, no multicollinearity was reported within variables, which was tested using the Variance Inflation Factor (VIF).

The study used SPSS (version 20) and STATA (version 14) as software packages for conducting the data analysis.

Results and Discussions

Summary Statistics

Table 1 provides descriptive information on each variable used in the study under two separate panels. Panel A gives the total number of sample observations, mean values, standard deviations and range of all key variables. All the variables are found to be symmetrically distributed, with no presence of outliers. The mean value of funding from the central government of India amounts to ₹9,233.03 lacs, ranging from zero to ₹1,39,288.2 lacs. For full 285 university-year observations, TLR, RPP, GO, OI and PP are observed to have average scores of 57.28, 26.78, 72.61, 54.24 and 22.29 per cent, respectively. This represents that on average, public universities have been performing well to some extent over the study period.

With regards to the control variables, the SIZE of the universities varies from as low as 1302 students to as high as 29066 students. The mean AGE of a university

Table 1: Descriptive Statistics

Panel A: Summary Statistics for the Sample Universities

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
CF (₹ In Lakhs)	285	9233.03	21795.49	0	139288.2
TLR (%)	285	57.28	10.56	28.85	84.55
RPP (%)	285	26.78	15.90	2.55	92.16
GO (%)	285	72.61	11.31	46.39	100
OI (%)	285	54.24	9.02	27.42	85.16
PP (%)	285	22.29	19.51	0	100
SIZE (No. of Students)	285	7668.15	6154.94	1302	29066
AGE (in years)	285	53.47	31.00	8	163

Panel B: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) CF	1							
(2) TLR	0.041	1						
(3) RPP	0.223***	0.210***	1					
(4) GO	0.375***	0.201***	0.433***	1				
(5) OI	0.197***	0.077	0.000	0.235***	1			
(6) PP	0.112*	0.280***	0.734***	0.369***	0.146***	1		
(7) AGE	0.254***	0.159***	0.249***	0.493***	-0.090	0.217***	1	
(8) SIZE	0.241***	-0.044	-0.294***	0.496***	0.072	0.312***	0.396***	1

Source: Author's calculations using STATA Version 14.

Notes:

(1) Table 1 provides descriptive data of 285 university-year observations, for a full sample of the Indian public universities over FY 2016-2020.

(2) The symbols *, ** and *** indicate the statistical significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

(3) Definitions of all the variables are given in Annexure 3.

is found to be approximately 53 years, suggesting that most of the public universities in India are relatively well established. Panel B reports correlation coefficients for all the selected variables in the study. Herein, CF appears to be significantly and positively associated with RPP, GO, OI, PP, AGE and SIZE. Further, the SIZE of the university is observed to have a significantly positive relation with university performance in terms of RPP, GO and PP. In addition, AGE (experience of a university) bears a significant and positive correlation with all performance parameters except OI, which is negatively associated with it.

Central Funding and University Performance

Using regression equation 1, Table 2 exhibits the findings for each dependent variable, i.e., TLR, RPP, GO, OI and PP under columns 1 to 5, respectively. Columns 1, 2, 4 and 5 show results based on the fixed-effect regression model for the full sample, while column 3 reports impact using the random-effect regression model. As discussed earlier, each performance model controls for the institutional factors, i.e., AGE, SIZE and IOWN of the university.

The regression results given above prove that CF has a significant influence on TLR (adjusted R^2= 14.3 per cent), RPP (adjusted R^2= 13.3 per cent), and GO (adjusted R^2= 38.9 per cent), while OI and PP are found to have a negative and insignificant relationship with CF. Hence, the study supports H_1, H_2 and H_3. As presented in Table 2, TLR (β = .858; p = 0.03), RPP (β = .250; p = 0.08) and GO (β = .604; p = 0.04) enter into regression equation with positive sign, implying that funding boost teaching and learning, research performance and graduation outcomes within a government-owned university. These results can be attributed to the fact that funding leads to increased financial accountability among these institutions, which inevitably results in effective utilization of all resources and thereby, improving their teaching, research and student services performance (Yi et al., 2015). Additionally, Dougherty & Reddy (2011) states that research and development grants intensify competition at the researcher's as well as institutional level, which further adds up to enhance research performance. In the context of the control variables, the AGE of the university has a significantly positive association with all performance parameters of NIRF, proving the experience of the public university to be an important factor in improving its performance. On the other hand, SIZE positively influences GO and PP only.

Conclusions and Implications

To achieve global excellence, educational institutions throughout the world are making efforts to elevate their performance, and universities are no exception

Table 2: Impact of Central Funding (CF) on University Performance (PERF)

Variables	PERF(TLR)	PERF(RPP)	PERF(GO)	PERF(OI)	PERF(PP)
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	Coef. *(t-value)*	*Coef.* *(t-value)*	*Coef.* *(t-value)*	*Coef.* *(t-value)*	*Coef.* *(t-value)*
Intercept	-94.598*** (-2.54)	-64.406*** (-2.56)	11.231 (0.97)	154.049*** (4.40)	-571.874*** (-10.78)
CF	.858** (2.15)	.250* (1.70)	.604** (2.01)	-.444 (-1.19)	-.896 (-1.58)
SIZE	2.280 (0.74)	-5.178*** (-3.14)	2.978** (2.21)	1.567 (0.55)	7.826** (1.80)
AGE	36.051*** (3.96)	35.174*** (5.11)	8.987*** (4.22)	28.901*** (3.38)	139.252*** (10.75)
IOWN (Dummy)	Included	Included	Included	Included	Included
Adjusted R^2	0.143	0.133	0.389	0.170	0.163
Number of observations	285	285	285	285	285
Hausman Test (*p*-value)	0.000	0.000	0.118	0.002	0.000

Source: Author's calculations using STATA Version 14.

Notes: (1) Table provides results of the regression equation 1 for the 285 observations of the sample of Indian public universities over FY 2016-2020.

(2) The t-statistics which are given in parentheses are based on robust standard errors.

(3) The symbols *, ** and *** indicate the statistical significance at 10 per cent, 5 per cent and 1 per cent levels, respectively.

(4) Definitions of all the variables are given in Annexure 3.

to it. To boost their performance, even the governments are designing several policies and practices for supporting these institutions financially. Given the deteriorating quality of education, tuition fee freezes and scant resources among the Indian public universities, NEP 2020 is one of such policies which envision improving their performance by devising performance-based funding schemes. These schemes primarily focus on developing accountability among HEIs for performing better to receive more government grants. Therefore, before implementing the performance-based funding mechanism within India, it is imperative to examine the impact of funds utilization on the performance parameters of the Indian public universities.

The present research is an empirical attempt to investigate the effect of central government funding on university performance, wherein funding has been measured as the grants received from the central government and performance has been analyzed in terms of five performance parameters framed by NIRF, India. For this purpose, the study employed fixed panel data regression analysis using data of 12 central universities, 12 deemed universities and 33 state universities for the five years, i.e., from FY 2016 to FY 2020. Herein, the education production function (EPF) was used as a theoretical foundation. The results of the study prove that the university's teaching and learning, research performance and student graduation outcomes are significantly and positively influenced by the financial support from UGC. Contradictorily, outreach and inclusivity of universities and perception of academicians, practitioners and students towards their universities are found to be indifferent towards the central funds. Above all, the age (experience) of university turns out to be the most significant factor strengthening the university's performance in all financial and non-financial aspects.

The aforesaid findings provide several insights to the state policymakers and university practitioners as well as researchers. Plausibly, the analysis of the funding-performance nexus can guide policymakers in the identification and formulation of effective performance parameters to be used for performance-based funding. Moreover, it can help university authorities in effective strategic decision-making by reinforcing their teaching, research and financial performance. Additionally, the research leaves a wider scope for further investigation as it is limited to the examination of university funding in terms of central funding only due to the data limitations. Future research can include the impact of funding received by public universities from the state governments as well as other research funding agencies. As a performance-based funding mechanism is still in the process of implementation within the Indian public universities, researchers can further explore the causal relationship between funding and performance once this mechanism is well implemented. Last but not the least, the study can be extended for cross-country analysis which may yield a different perspective for designing state-funding mechanisms.

Annexures

Annexure 1: Sample selection Criteria

Selection Criteria	No. of Universities
Total number of universities ranked in the top 100 in the 'university' category in the India Ranking report, 2021 (based on NIRF)	100
Less:	
Private universities, privately-funded deemed-to-be-universities and Institutes of national importance, as these are not public entities	(14)
Universities not ranked consecutively in the top 100 universities in Ranking reports during the period from 2017 to 2021	(11)
Universities not receiving grants from UGC on a consecutive basis through the entire study period	(18)
Final sample size	57

Note: The sample observations account for total of 285 University-year observations (57 universities over 5 years).

Annexure 2: Parameters of University Performance based on NIRF

Acronym	Parameter	Sub-parameter	Marks	Overall Weightage
TLR	Teaching, Learning and Resources (100 marks)	A. Student Strength including Doctoral Students (SS)	20	0.30
		B. Faculty-student ratio with emphasis on permanent faculty (FSR)	30	
		C. Combined metric for Faculty with PhD (or equivalent) and Experience (FQE)	20	
		D. Financial Resources and their Utilization (FRU)	30	
RPP	Research and Professional Practice (100 marks)	A. Combined metric for Publications (PU)	35	0.30
		B. Combined metric for Quality of Publications (QP)	35	
		C. IPR and Patents: Published and Granted (IPR)	15	
		D. Footprint of Projects and Professional Practice (FPPP)	15	

(Table continued)

(Table continued)

GO	Graduation Outcomes (100 marks)	A. Metric for University Examinations (GUE)	60	0.20
		B. Metric for Number of PhD Students Graduated (GPHD)	40	
OI	Outreach and Inclusivity (100 marks)	A. Percentage of Students from Other States/Countries (Region Diversity RD)	30	0.10
		B. Percentage of Women (Women Diversity WD)	30	
		C. Economically and Socially Challenged Students (ESCS)	20	
		D. Facilities for Physically Challenged Students (PCS)	20	
PP	Peer Perception (100 marks)	A. Peer Perception: Academic Peers and Employers (PR)	100	0.10

Source: India Ranking Report, 2021.

Annexure 3: Variable description

Variable Name	Acronym	Variable description
Panel A: Dependent variable		
Teaching, Learning and Resources	TLR	Total score out of 100 based on the sum total of scores of SS, FSR, FQE, and FRU with a weightage of 20, 30, 20 and 30 per cent, respectively.
Research and Professional Practice	RPP	Total score out of 100 based on the sum total of scores of PU, QP, IPR, and FPPP with a weightage of 35, 35, 15, and 15 per cent, respectively.
Graduation Outcomes	GO	Total score out of 100 based on the sum total of scores of GUE and GPHD with a weightage of 60 and 40 per cent, respectively.
Outreach and Inclusivity	OI	Total score out of 100 based on the sum total of scores of RD, WD, ESCS, and PCS with a weightage of 30, 30, 20, and 20 per cent, respectively.
Peer Perception	PP	Total score out of 100 based on a survey conducted by NIRF among academic peers and employers regarding their perception of their university.
University Performance	PERF	As measured in terms of TLR, RPP, GO, OI and PP.
Panel B: Independent variable		
Central Funding	CF	Sum total of all plan and non-plant grants received by a university from the University Grants Commission, India.
Panel C: Control variables		
Size of a University	SIZE	The natural logarithm of the total number of UG, PG and PhD students enrolled in a year.
Age of a University	AGE	The natural logarithm of the number of years since the university's establishment.
Type of Ownership	IOWN	1 for each type of university, i.e., central university, state university and a deemed university.

Source: Drawn from literature.

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