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ACCESS, QUALITY AND FINANCING: EXPLORING THE TRIUMVIRATE IN CONTEXT OF NEP 2020 HIGHER EDUCATION GOALS

SANDHYA DUBEY[#]

Abstract

The goals of simultaneously enhancing access and quality in higher education have received respectable attention from policymakers worldwide. To achieve the twin goals of increasing access and quality, a combination of funding sources is used in higher education institutions globally. These include public education finances, household's financial supports, foreign aid, student loans and funding from specialized institutions (Yang & McCall, 2014; Dubey, 2019). Despite these diversified financial sources, the resource crunch does not allow higher education systems to achieve both unimpeded mass access and their full potential quality. Sustainable extension of tertiary education coverage, elimination of inequalities of access and outcomes, improvement of educational quality and relevance- all present challenges for developing and transitioning countries (Salmi, 2002). Consequently, fulfilment of the goals of mass access to higher education along with high and sustainable quality with the given government budget has emerged as a major challenge globally especially in developing countries. In the Indian context, this reflects in the NEP 2020 goals of attaining 50 percent GER in higher education by 2035 and enhancing quality of higher education. It also aims to allocate 6 percent of GDP to the education sector.

The paper analyses trends in Indian higher education, offering a comprehensive analysis of access, quality, and financing in higher education. Using time series data collected from United Nations Educational, Scientific and Cultural Organisation (UNESCO), All India

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Survey on Higher Education (AISHE), Analysis of Budgeted Expenditure (Ministry of Education) and Ministry of Statistics and Programme Implementation (MoSPI), the paper uses simultaneous equation models (SEM) to establish an empirical relationship between access, quality and financing of higher education in India to better inform the implementation of the NEP 2020 goals. Multiple models and testing methods, including the 3 Stage Least Square (3SLS) and Full Information Maximum Likelihood (FIML), are used to establish the relations between endogenous and exogenous variables. Graduation rates and research output serve as quality indicators, helping us understand the impact of teaching and research activities in tertiary education. A positive correlation is found between access to higher education and subsequent increases in quality.

The paper further discusses potential funding strategies that India could implement in order to achieve its NEP goal of achieving 50 percent GER in higher education with relatively high quality and low cost. The three proposed financing strategies are the Quality Dominated Funding Model (QDM), Access Dominated Funding Model (ADM), and Maximized Digital Substitution Funding Model (MDSM). The Quality Dominated Funding Model (QDM) suggests an increase in overall public expenditure while also reducing per capita student funding, with the aim of financing the quality by internationalizing, investing in research infrastructure and pursuing outcome-oriented goals.

Keywords: Access, Quality, NEP 2020, Public Expenditure on Higher Education, Economic Growth, Digital Revolution

I. Introduction

> Knowledge is like money: to be of value it must circulate and in circulating it can increase in quantity and hopefully, in value.
>
> – Louis L'Amour

The quote summarizes the importance of the exchange of knowledge and ideas to increase its quantity, which in turn enhances its value and quality. Noble Laureate Paul Romer's research shows that postsecondary education accelerates research and innovation by both educating and promoting the exchange of ideas, which occurs when educated people are

brought together (Carmody, 2018). These ideas fuel the growth and development process. The positive correlation between education and economic growth and development of a country is evident in human capital theories and endogenous growth models (Scultz, 1961; Becker, 1975; Romer, 1994). Therefore, in the 21st century, countries worldwide are competitively investing in their higher education systems.

Due to the huge spike in the demand for higher education, one of the fundamental shifts impacting higher education globally has been the massification of higher education. Enrollment in higher education has increased significantly over the past 50 years in almost every country including India (Trow, 2006, 1972; Tight, 2019; Dubey, 2019). This expansion has given rise to a general assumption that massification has resulted in rising average class sizes and increasing pupil-teacher ratios at both the national and institutional levels (Buckner & Zhang, 2021; Chang, Nyeu, & Chang, 2015; Hornsby, 2014). This has emerged as a major concern in the arena of higher education because increasing the number of students per faculty is thought to be associated with fewer opportunities for teacher-student interactions and negatively affects the quality of teaching and research in higher education (Buckner & Zhang, 2021). The important question that surfaces is that as the demand for education is much higher than the supply, does the demand-supply gap in higher education lead to quantity-quality trade-off? Nevertheless, while dealing with this trade-off the goals of the simultaneous increase of access and quality in higher education have received significant attention from policymakers across the world.

Worldwide, higher education institutions use a variety of funding sources to meet the dual objectives of improving access and quality. These include finances for public funding from state, financial assistance from households, student loans, foreign aid, and funding from specialised organisations (Dubey, 2019; Yang & McCall, 2014). The lack of resources prevents higher education systems from reaching their full potential and enabling unrestricted mass access, despite these diverse funding sources. Hence, the objectives of reducing access and resulting disparities, improving educational quality and relevance, and expanding tertiary education coverage in a sustainable manner are difficult for developing and transitional nations to achieve (Salmi, 2002).

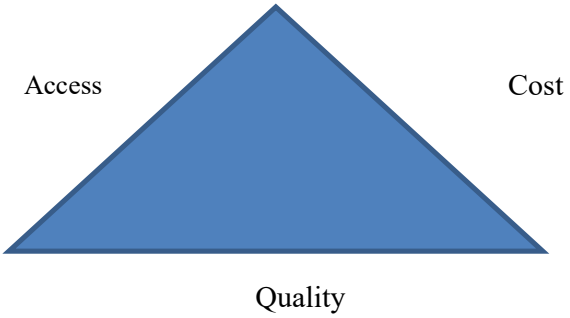
Achieving both high and sustainable quality and widespread access to higher education within the constraints of the government budget has become a significant global problem, particularly for developing nations. All these arguments together put forward a hypothesis that there exists a quantity-quality trade-off in higher education while realizing the goals of access and quality with limited resources.

However, Rothchild and White (1995) claimed that many services give outputs that rely partially on customers as inputs; the presence of other customers frequently influences the outcome experienced by each purchaser. Higher education is an excellent example of such a service. Students in higher education are prosumers, that is, both producers and consumers. Students and higher education institutions meet in a peculiar competitive market and are guided by technical relationships. Students provide monetary and quality inputs that influence each other's learning via peer interaction. On the other hand, institutions provide grants, scholarships, and educational services to build human capital. As a result, this technical relationship assumes that two transactions occur simultaneously. Students, as customers, pay a price for education, while the same student, as the supplier of input (peer quality), is reimbursed by the higher education institution in the form of financial assistance, grants, or subsidies, leaving only a net tuition payment (Winston, 1999). This argument adds an extremely important insight into the access, quality and financing dynamics of HE and prevents us from reaching a premature conclusion of a quantity-quality trade-off. Rather, it makes the access-quality-financing relationship quite ambiguous and a matter of curiosity. At the national level, Hansen and Stampen (1989) empirically proved the need for and pattern behind the balancing of access and quality in the financing of higher education. They illuminated the pendulum-like swing in society's interest in promoting greater access to higher education and enhancing its quality of higher education. With limited financial resources, the state can focus on one goal at a given period, and in the next period, can switch its priority to another goal and again back to the previous goal in the following period. Hansen and Stampen also argue that factors exogenous to the higher education system determine the priority accorded to access and quality in higher education for the state. For example, the American baby boom called for the expansion of access to higher education a decade

later. On the other hand, the Sputnik shock led to massive investments in enhancing the quality of higher education.

We infer from the above arguments that there is a multidimensional relationship between access and quality in higher education, which has a profound impact on the policies of education finance at both the institutional and national levels. Providing wide access to high-quality higher education at a low cost is the ambition of education ministers, which makes the iron triangle of the three vectors of access, quality, and cost difficult to break (Daniel, Kanwar, & Stamenka, 2009).

Figure 1: The Iron Triangle of Access, Quality and Cost



Source: Breaking the Higher Education's Iron Triangle (2009)

Keeping the above context in mind, I propose studying higher education planning as a system of three endogenous variables: access, quality, and financing, and other important exogenous variables such as economic growth, digital revolution, access to basic education, fiscal capacity, and priority according to education in the budget, privatization of higher education, and internationalization. Section II contains the methodology, research questions, and objectives, followed by Section III, which contains the results of empirical testing of the A-Q-F model at international, national, and institutional levels. Finally, Section IV concludes and provides insights into the policy implications, limitations, and future scope of the research.

Research Gap

The contributions of many researchers to developing ideas and assessing the impact of finances on access-quality linkages are valuable and widely available. However, there has been a lack of convincing evidence, whether theoretical or empirical, regarding the interaction of the goals of access, quality, and finance of higher education while taking economic growth, basic education, and the digital revolution into account. There is room for such a comprehensive approach. Furthermore, no existing research in India has produced empirical evidence as to whether or not there is a multi-causal relationship between higher education access, quality, and financing. In particular, the analytical methods used in the current research on how financial policies affect access to and the quality of higher education in India are primarily descriptive in nature and only produce tentative findings. Furthermore, no such experiment involving the development and empirical testing of a theoretical structural model on the dynamics of access, quality, and financing in higher education has been carried out as of yet. Thus, the purpose of this study is to elucidate the numerous facets of the access-quality relationship and how it affects funding for higher education. It also seeks to investigate how access-quality dynamics are affected by the digital revolution.

Research Objectives

Based on these research questions, the two research objectives of this study are as follows:

- Constructing a theoretical model of a higher education system with access, quality, and financing as the three major goals
- To study and empirically test the access quality financing dynamics of Indian higher education

II. Methodology and Data

This research is based on the positivist paradigm. Objective and observable stylized facts were derived from the existing literature to construct a theoretical Access-Quality-Financing Model (hereafter A-Q-F model). Further, the A-Q-F model is tested using

simultaneous equation testing methods–three stage-least squares and maximum likelihood at the national level for India from 1990 to 2018.

A-Q-F Simultaneous Equation Model

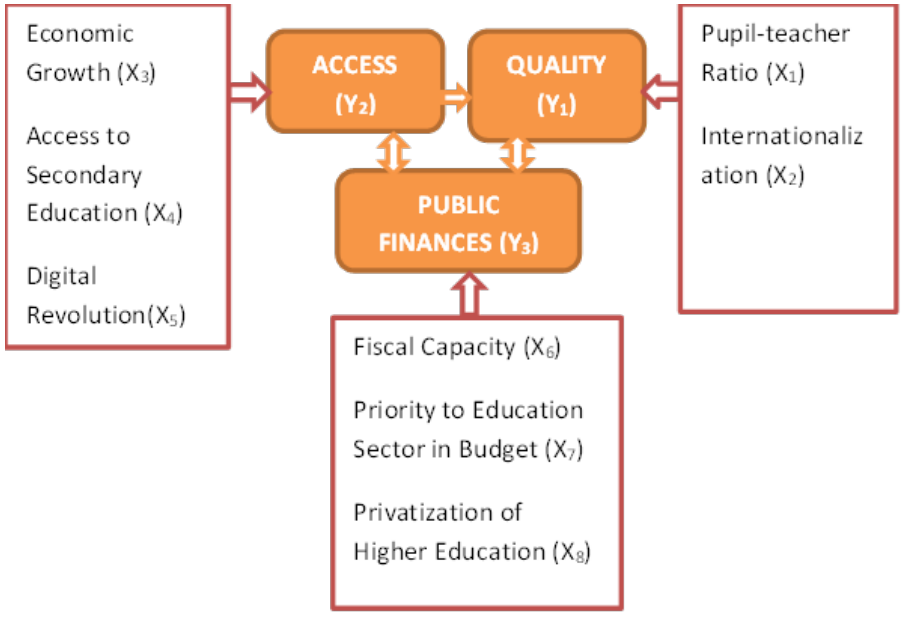
In the model specification of higher education systems, we used the prior theory from a literature review to construct the A-Q-F equations. Theory is important in model development because it defines the theoretical or structural relationships between variables of interest. Variables of a simultaneous equation model can be linked together by direct links, indirect interactions, reciprocal relationships, feedback loops, and/or disturbance correlations.

In the A-Q-F model, the equations under investigation are part of a wider phenomenon. Therefore, the aim is to explain these variables using a system of equations. The higher education system has been established as a system of three endogenous variables: access, quality, and public funding of higher education. It is outside the purview of this study to give a comprehensive theory of higher education regarding the interplay between the various aspects of educational access, quality, and financing. This section aims to present the rationale behind the identification of constraints in our SEM for higher education. Therefore, keeping in mind Ockham's razor concept, only a small number of variables were chosen. The identification of the equations for these three variables is suggested by the conceptual framework (fig. 2). The following three equations make up the framework.

Quality: $Y_{1it} = \beta_{11} X_{1it} + \beta_{12} X_{2it} + \Pi_{12} Y_{2it} + \Pi_{13} Y_{3it} + \varepsilon_1 it$ **(1)**

Higher education quality depends on the number of students enrolled in higher education, public financing to higher education, pupil-teacher ratio and internationalization of higher education. The student cohort influences higher education quality in two ways- one is by their knowledge at the entry point and the other by peer interaction until they exit the higher education system. One of the main demerits associated with human capital is that it depreciates over time because of mortality and disease. However, this is not true when we look at the human capital received and contributed by the students in higher education setup as it increases exponentially. The next important hypothesis is that the pupil-teacher

Figure 2: Framework showing relationship between Endogenous and Exogenous Variables of A-Q-F HE Model



Source: Author's compilation

teacher ratio has a direct negative relationship with higher education quality. The reason for such a claim is that, as the pupil-teacher ratio increases, the per-student time and attention by the teacher decreases, which dilutes the quality of teaching learning. Another important variable taken as the determinant of quality is the international mobility of the students. In India's case, the outflow of the students to foreign countries is much more than the inflow. Although the inbound mobility of international students reflects better the quality of higher education, however students' outflow also adds to the quality of higher education by exposing the domestically trained students to the more advanced teaching and research ecosystems of foreign countries especially the developed nation. International students add to the cultural diversity and different perspectives on higher education. This enhances dynamism and enriches overall peer engagement in the higher education system. Finally, the impact of Internet penetration on the economy is also hypothesized to influence the quality of higher education.

Access: $$Y_{2it} = \beta_{24} X_{4it} + \beta_{25} X_{5it} + \beta_{26} X_{6it} + \Pi_{21} Y_{1it} + \Pi_{23} Y_{3it} + \varepsilon_2 it \qquad (2)$$

Equation (2) indicates the potential determinants of access to higher education: The quality of higher education influences the overall social opinion regarding the higher education sector and therefore helps in cultivating demand for the same. Second, students in the secondary sector are potential demanders of higher education. The enrollment in secondary sector is, therefore, one of the important determinants of the demand aspect of access to higher education. In addition, with an increase in public spending per capita in higher education, access to higher education should increase, as it reflects how the government's spending is aligned with the increase in higher education enrolment. The other important public finance variable that influences access to higher education is the share of tertiary education of the GDP of the country. This variable demonstrates the overall priority of tertiary education in the country's policy. Next, private spending on education increases with an increase in per capita income, and the household's capacity to spend on higher education increases. Finally, after the advent of the Internet revolution in the early 2000s, there is an enormous amount of literature claiming a positive impact on access to higher education. The Internet revolution has affected both the demand for and supply of higher education. It has diluted information asymmetry and opened the floodgates of virtual learning.

Public Funding: $Y_{3it} = \beta_{36} X_{6it} + \beta_{37} X_{7it} \ldots + \beta_{38} X_{8it} + \Pi_{34} Y_{1it} + \Pi_{33} Y_{2it} + \varepsilon_{3it}$ **(3)**

Equation (3) indicates the factors that determine public funding for higher education. Access to higher education influences public spending on it in two ways. First, with an increase in enrollment in the higher education system, demand for funding increases; thus, there is a positive relationship between access and public funding for higher education. Second, with the increase in higher education enrollments, per capita spending in higher education decreases if the increase in public spending on higher education is proportionally less than the increase in enrollments in higher education. The privatization of tertiary education, represented by the percentage of students enrolled in private institutes, influences public spending on higher education, which is an interesting relationship for analyses. Next, we hypothesize that the quality of tertiary education is positively related to public finance and tertiary education. This is because the goal of improving higher education quality influences the higher education budget. Another

important variable that influences the state's capacity to spend on education is the tax-GDP ratio, which demonstrates the fiscal capacity to undertake developmental expenditure. To a certain extent, the tax-GDP ratio reflects the degree of formalization in the economy, tax compliance, and the strength of the fiscal laws and tax structure of the country. Finally, the overall priority accorded to educational finance is hypothesized to have a positive relationship with public spending on higher education. Priority to educational finance is represented by education's share of total government expenditure.

Table 1*:* Data Description

Variable	Indicator	Source
Quality	Cumulative Research Output (M_1) and Graduation Rates (M_2)	Annual reports of Controller General of Patents, AISHE
Access	GER in Tertiary Education	World Bank, AISHE
Public Finance	Per Capita Expenditure on Tertiary Student as the percentage of per capita income	World Bank
Pupil-Teacher Ratio	Pupil-Teacher Ratio	Calculated by dividing total tertiary enrolments with total faculty in tertiary education using UNESCO data.
Internationalization	Outbound Student Mobility for Higher Education	UNESCO statistics
Access to Secondary Education	GER in Secondary Education	World bank, Unified District Information System for Education
Economic Growth	Natural Log of Per Capita Income at Constant $ year 2017	World Bank, MOSPI
Digital Revolution	Percentage of Population using internet	World Bank
Fiscal Capacity	Tax Revenue-GDP Ratio	Reserve Bank of India
Priority to Education Sector	Percentage of Total Government Expenditure allocated to Education Sector	Reserve Bank of India
Privatization of HE	Percentage of total tertiary enrolments in private institutes	UNESCO statistics

Source: Author's compilation

Variables and Data

Based on the objectives of the study, a brief theoretical framework, and the availability of data, three endogenous and eight exogenous variables were formulated to address the research objectives. The indicators and sources of the variables for the empirical analysis of the A-Q-F model at the national levels (Case of India, for 1990 to 2018) are given in table 1.

Limitation of the Data

The study's variables still have inherent issues, despite the data collection agencies' constant efforts to improve the quality of the data. There are a lot of missing data points in the sample. Interpolation techniques were employed since it is believed that the mechanism causing the missing values is entirely random. The average of the two data points from years that were close together was used to correct for missing values. The country mean was used to fill in the missing values when there were still a large number of missing values in the variables.

III. Results and Discussion

Indian higher education has entered the massification phase, wherein a strategic emphasis is being placed on improving quality, and efforts are well evident in NEP 2020. This presents a unique set of opportunities and challenges, and the growth experienced in the last two decades is unprecedented. With 1,043 universities, 42,343 colleges, and 11,779 freestanding institutions, it has expanded to become one of the largest in the world's higher education market, second only to China (Ministry of Education, 2020). India's youth population is expanding quickly, which has led to an increase in the country's college-age population. India's GER in 2019–20 was 27.1 percent (Ministry of Education, 2020). The Ministry of Education's goal of 32 percent GER by 2022 was not met.

It is significantly lower than the 80%+ participation rates in higher education seen in some parts of North America and Europe, China (51%+), and much of Europe as per the World Bank data for 2019-20. However, while the proliferation of these private

institutions has contributed significantly to the growth of India's higher education enrolment capacity, the quality is inconsistent.

When comparing institutions in India with those around the world, there is a significant quality gap. The National Institutional Ranking Framework (NIRF) 2021 of India found that nine of India's 28 states—Karnataka, Kerala, Maharashtra, Tamil Nadu, Telangana, Gujarat, Haryana, and West Bengal—had the highest concentration of top colleges in the country. States with fewer resources have a harder time in providing high-quality education. Compared to the United States and China, India has been more supportive of the growth of these localized institutions. The Brookings Reviving Higher Education study found that while Indian universities averaged 690 students per institution, Chinese universities averaged over 16,000 (Ravi, Gupta, & Nagaraj, 2019). As many employers in India have doubts about the competence of recent college graduates, it is difficult to place them in suitable positions. A recent survey by Wheebox and the Confederation of Indian Industry (India Skills Report, 2021) found that respondents rated the employability of college graduates as less than 50%, as reported in the Indian Skills Report. The lack of federal and state funding, ineffective organizational frameworks, excessive bureaucracy,

and corrupt officials also pose serious challenges to the industry. The NEP 2020 and the Education Quality Upgrading and Inclusion Programme (EQUIP, 2019) are aimed at resolving the problems and directing the entire higher education system of the country. There are three primary proposals for improving the availability, quality, and government support of higher education. First, to increase GER from the current 27.1% in higher education to about 50% by 2035. Second, to improve the quality of higher education, it is proposed to launch a worldwide program of academic networks to work with the world's leading scientists and businesspeople to fortify the country's existing academic infrastructure, speed up the rate of quality improvement, and bring India's scientific and technological prowess to the level of international excellence. A Program for the Promotion of Academic and Research Collaboration that employs international scholars is also being promoted to make the Indian education system more competitive. The consolidation and reorganization of the system also recommends that college enrollments should comprise at least 3,000 students. Lastly, the goal of increasing public education

expenditure to 20% of overall government spending within a decade and also to increase the percentage of GDP spent on education to 6% is proposed.

While such large investments would be welcome, there is little evidence to suggest that they would be made, especially when after the pandemic shock most of the state's funds were channeled in strategic sectors to keep the economy on track (Khare & Dubey, 2021). Public university enrollment is expanding at a slower rate than that in basic and secondary schools. To bridge the demand and supply gap in the Indian higher education system, instead of expanding public infrastructure, the government encouraged private-sector growth in higher education. There are currently more private universities than public ones, and this gap is expected to expand. Philip Altbach, an internationally acknowledged educationist, on his commentary on India's NEP said, "It is not enough to announce these things; they take money and follow-through, and there are a lot of powerful negative forces that continue to the present" (Tobenkin, 2022).

This leads to the argument that emphasis on quality entails limitations on quantity, and the rush to increase capacity with limited resources highlights trade-offs and forces hard choices. Thus, there is an access-quality trade-off in Indian HE, and how this relation affects the allocation of public finance across education levels is an important question and the following section offers the answers.

Empirical Results of Simultaneous Equations A-Q-F HE Model at National Level

Table 2 summarizes the descriptive statistics for all variables used in the simultaneous equation model for assessing the case of India from 1990 to 2018. The high education GER increased from 5.6 percent in 1990 to 26.9 in 2018. The average per-capita tertiary public spending as a percentage of GDP per capita was 8.26 percent in the given time period. The fastest increasing exogenous variables in the model are GER in secondary education, which increased from 43.2 perecent to 74.3 percent and the percentage of population using the Internet increased from almost 0 percent in 1990 to 34.8 percent in 2018.

Table 2: Descriptive statistics of the variables used in the A-Q-F Model of HE at National Level.

Variable	Obs	Mean	Std. Dev.	Min	Max
AccesstoHE	28	13.50893	7.678566	5.6	26.9
QualityofHE	28	3.571429	2.669096	.5484822	7.570542
PublicFina~E	28	8.267797	.4071253	7.14119	9.121322
GER_SE	28	55.08929	11.15588	43.2	74.3
PublicExp~SE	28	24.67324	.4978045	24.06025	25.62076
PublicExp~SE	28	24.67324	.4978045	24.06025	25.62076
EconomicGr~h	28	14.93641	.5572544	14.11405	15.88252
PerCapitaI~e	28	10.24753	.4283041	9.664469	11.00275
FiscalCapa~y	28	15.41071	1.482353	12.92	17.95
TotalExpen~u	28	13.45427	.8000239	11.97835	14.89
InternetPe~a	28	6.615669	10.27877	0	34.8
BrainDrain	28	11.36623	1.171158	8.488999	13.22391

Source: Author's compilation

Model Results

This study presents a thorough overview of alternative analyses of panel data and compares the advantages and limitations of four simultaneous equation models (Table 3). Model 1 uses Graduations Rates (GR) as the quality indicator, whereas Model 2 uses Research Output (RO) as the quality indicator of higher education. The reason for choosing two quality outcome indicators is to conclusively derive the inference from the model, as teaching and research are the two most important higher education activities. Graduation rates reflect the quality of teaching in higher education and dropout rates, while contribution to research and innovation indicates the quality of the research activity conducted and facilitated by higher education in the education and overall economic system of the country. Further in Table 3, A denotes the results of 3 stage least squares (3-SLS) model and B denotes the results of the Full Information Maximum-Likelihood (FIML) method for testing Simultaneous Equation models. Two testing methods were

used to confirm the direction of the relationship between endogenous and exogenous variables. The final interpretation is based on the FIML results because it is proven that FIML is asymptotically more efficient than the nonlinear 3-SLS estimator if the specification is correct (Amemiya, 1977).

The results of the simultaneous equation models achieve the research objectives of assessing the A-Q-F scenario at the national level, with some discourses enriching the findings. All models confirm a statistically significant positive relationship between access and quality (0.33*** for GR and 0.36*** for RO). This finding needs to be analyzed along with the other important result of the negative association between the higher education quality and pupil-teacher ratio of the magnitude of -0.23 for GR and -0.14** for RO. As students' enrollment increases, peer engagement also increases, which has a positive influence on higher education quality by enhancing GR and RO, but the pupil-teacher ratio deflates if teacher recruitment does not proportionally align with the rate of increase in student enrollment and negatively influences higher education quality.

Table 3: Results of the 3-Stage Least Square and Maximum Likelihood Methods of Testing Simultaneous A-Q-F Model of Higher Education at India Level

STRUCTURAL EQUATIONS	India			
	$Model1_A$	$Model1_B$	Model 2_A	$Model2_B$
QUALITY				
Access	0.12*	0.33***	0.3***	0.36***
Per-pupil public spending	1.47**	0.84*	-0.82**	-0.41
Pupil-Teacher Ratio	-0.38	-0.23	-0.22**	-0.14**
Internationalization	1.2*	1.49***	0.93***	0.13**
ACCESS				
Per-pupil public spending	0.005**	-1.19	-2.3*	-1.11
Access to SE	0.60***	0.63***	0.57**	0.63***
Digital Revolution	0.08	0.12*	0.16**	0.12*
Per-Capita Income	0.62	-1.19	-0.004	-1.25
PUBLIC FINANCING				
Access	-0.7***	-0.05***	-0.09**	-0.10***
Quality	0.17***	0.089*	0.14	0.21*
Fiscal Capacity	0.16**	0.17**	0.27***	0.19**
Education's Priority in Budget	0.17***	0.287***	0.36**	0.45***
***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level.				

Source: Author's compilation

It is interesting to observe that the impact of access and pupil-teacher ratio is the same in direction but differs in magnitude, as it influences GR more than RO. Another important finding is that internationalization has a strong positive relationship with higher education quality for GR and RO. In fact, the number of students studying abroad has increased, thus enhancing the global networking of Indian higher education. More than brain drain, outgoing students help in technology transfer and express international research and innovation in the Indian context. Hence, in the case of India, internationalization, even if indicated by the outgoing students, emerges as the biggest influencer of higher education quality in both the FIML models. Finally, per-pupil public spending has a positive impact on HE quality when indicated by graduation rates, but an insignificant impact when indicated by the research outcome.

The second equation for access demonstrates a negative but insignificant relationship between higher education access and per capita higher education spending (-1.11), and an insignificant relationship with per capita income. As the enrollment ratios increase, the per capita spending decreases because tertiary enrollments increase at a much higher speed than public finance in higher education. On the other hand, with the increase in the economic growth of the country, per capita income also increases and the capacity of the masses to spend on education increases. Another important result is that a one-unit increase in the enrollment ratio in secondary education increases the HE enrollment ratio by 0.63*** units. Finally, internet penetration was found to have a positive and significant (0.12*) impact on HE access in all four models.

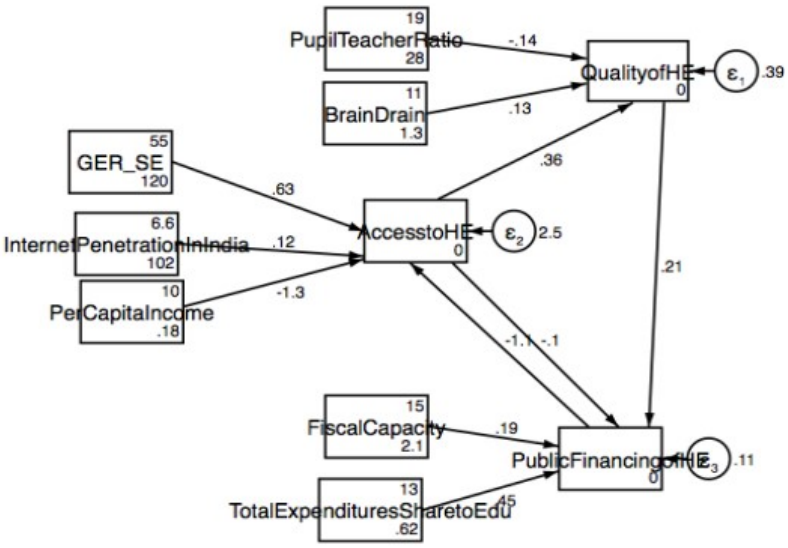
The third equation demonstrates the negative influence of access (-0.10***) and positive influence of quality (0.21*) on per capita funding in higher education. Next, an important finding pertaining to public spending on HE is that the fiscal capacity of the country represented by the tax-GDP ratio has a strong positive influence (0.19**) on the public financing of higher education. This is mainly because, with enhanced fiscal capacity, governments are in a better position to carry out social expenditures. Finally, the priority that the state accords to the overall education sector in comparison to other sectors in budgetary finances has a strong and positive influence on per capita public spending in HE (0.45***).

Direct and In Direct Effects for Decoding the Access-Quality Dynamics in Financing of HE

There are direct, indirect, and total effects in the simultaneous equation models. One variable's direct impacts on another are those that happen without the help of any other variables in the model. Paths that pass through at least one variable on their way from one variable to another are known as indirect effects. The total effects, which indicate how much change in the outcome variable should occur for a given shift in the antecedent variable, are the sum of the direct and indirect effects. Tracing paths that demonstrate direct, indirect, and total impacts is made possible by specifying a model as a path diagram (Amemiya, 1977). In the path diagram in figure 3 and table 4, one can see that there are four direct and three indirect effects between the endogenous variables of access, quality, and public funding in higher education. Based on these direct and indirect effects, we trace the impact of the dynamics between access and quality on the financing of higher education at the national level.

As higher education enrolments increase at a significantly higher speed than public funding, per-tertiary student expenditure decreases (-0.01*) as the GER rises. However, interestingly, the indirect impact of the increase in GER on the public funding of higher education is positive (0.29*) as it travels by positively affecting higher education quality. The rise in higher education quality in turn increases the cost of education and thus demands more public funding. In the case of India, the A-Q dynamics enhance economic growth, which has an insignificant impact on access to higher education and an indirect insignificant positive impact on per-capita public funding (0.04). This is mainly because, in India, higher education enrolment still needs the support of public funding, and the increase in economic growth is not sufficient to significantly influence higher education access. On the other hand, the direct and indirect effects of higher education quality on per capita public spending are positive. Thus, as higher education expands the need for public funding increases to enhance the quality of higher education. Thus, we cannot rely on economic growth to fund access to and quality of higher education for India.

Figure 3: Path Diagram Showing the A-Q-F Model of Higher Education estimated using FIML Method at National Level.



Source: Author's compilation

In the case of India, the expansion of access to secondary education and the Internet revolution influence access mostly in comparison to the other variables. Digital revolution also influences higher education quality positively indirectly by directly affecting higher education access.

In summary, the findings of the study prove that when per capita income rises, the burden of supporting access to higher education shifts to private sources, whereas state spending rises primarily to improve the quality of higher education by increasing investment in research and innovation. On the other hand, as investment in science and technology grows, so does the economy and the possibility of financing access through private funding sources. Consequently, a pattern emerges in which public spending on higher education rises to pay for improvements to its quality, but per-student funding for higher education declines as student numbers increase because the increase in enrollment is attributable primarily to rising incomes and the privatization of higher education.

Table 4: Direct-Indirect and Total Effect of all the Variables on Endogenous Variables using Fixed Information Maximum Likelihood Method at National Level

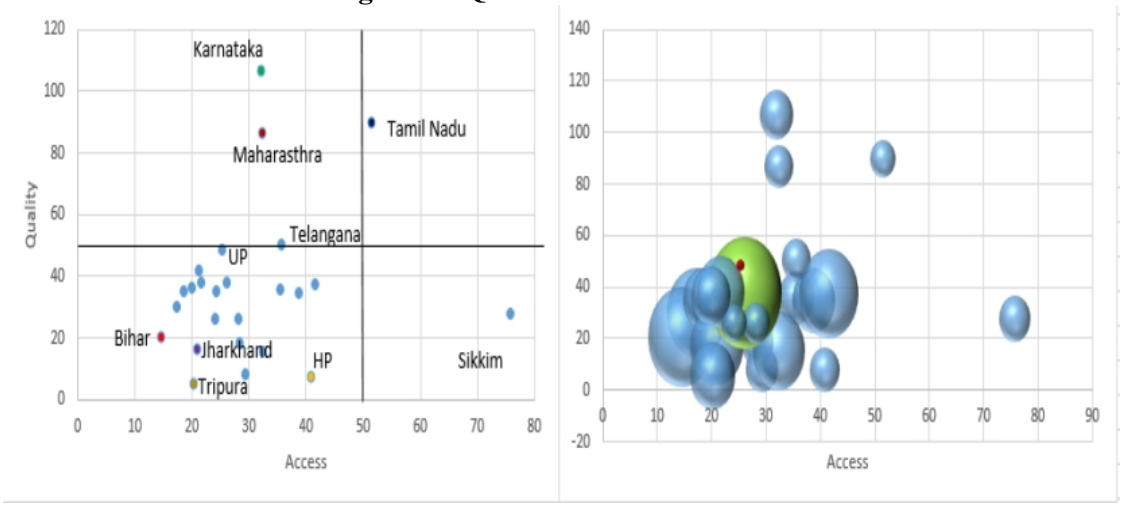
Variables	Direct	In-direct	Total
QUALITY			
Access	0.36***	0.01	0.37***
Pupil-teacher Ratio	-0.14***	0.01	-0.13***
Internationalization	0.13**	-0.01	0.12***
Per-Pupil Public Spending on HE		-0.41	0.41
Access to Secondary Education		0.23***	0.23***
Digital Revolution		0.04*	0.043*
Per-Capita Income		-0.46	-0.46
Fiscal Capacity		-0.08	-0.08
Priority to Education in Budget		-0.18	-0.19
ACCESS			
Quality		-0.25	-0.25
Pupil-teacher Ratio		0.03	0.03
Internationalization		-0.03	-0.03
Per-Pupil Public Spending on HE	-1.11	-0.04	-1.15
Access to Secondary Education	0.63***	0.2	0.65**
Digital Revolution	0.12*	0.004	0.12*
Per-Capita Income	-1.25	-0.04	-1.3
Fiscal Capacity		-0.21	-0.21
Priority to Education in Budget		-0.5	-0.52
PUBLIC- FINANCE TO TERTIARY EDUCATION			
Access	-0.01***	0.76*	0.29*
Quality	0.21*	0.007	0.22*
Pupil-teacher Ratio		-0.03*	-0.03*
Internationalization		0.03*	0.03*
Access to Secondary Education		-0.018*	-0.02*
Digital Revolution		-0.003	-0.003
Per-Capita Income		0.04	0.04
Fiscal Capacity	0.19**	0.006	0.2**
Priority to Education in Budget	0.45***	0.014	0.46***
***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level.			

Source: Author's compilation

IV. Conclusion and Policy Suggestions

Looking at the A-Q-F scenario at the level of the Indian states, figure 4 provides interesting insights demonstrating high regional inequalities in HE in Indian states.

Figure 4: Four Quadrants Showing A-Q Dynamics for HE Systems of Indian States and the 3D Bubble Showing the A-Q-F Scenario in India



Source: Author's compilation

As size of the bubble shows the public spending on higher education, we can see that most of the states are in the 1st quadrant of low access and low quality with relatively high public spending in comparison to better-performing states. High regional disparities in the A-Q-F scenario pose a serious impediment to achieving the NEP 2020 goals. Tamil Nadu is the only state in 4th quadrant entering the universalization phase of expansion with relatively high quality. The special category states in 1st quadrant have relatively more subsidised higher education compared to other states in the 1st Quadrant. To reach the 4th quadrant, Indian states must enhance the forward and backward linkages between secondary and higher education. This will boost access to higher education, which will further enhance the quality of higher education as the more the merrier is true for Indian higher education, provided the proper peer-learning enhancing policies are in place. High access leads to high peer interaction which enhances the enriching deliberations over new ideas and paves the path for better quality in higher education. Next, the states should strategically try to balance their pupil-teacher ratio, which would further contribute to reducing impediments in enhancing the quality of higher education for the masses.

To attain India's ambitious fourth quadrant goal of achieving a 50 percent GER in higher education while maintaining high quality and low costs, several key financing strategies can be formulated based on the insights gleaned from this study.

Firstly, the Quality Dominated Funding Model (QDM), emphasizes increasing public expenditure on higher education, particularly directed towards enhancing quality through internationalization efforts by inviting international faculty and increasing the inbound mobility rates of international students, investing in research infrastructure, and prioritizing outcome-oriented measures. This model suggests a shift towards state-of-the-art infrastructure and focus on quality-driven outcomes. Second, the Access Dominated Funding Model (ADM) focuses on improving access to higher education by strategically deploying public funds. This involves implementing low-cost policies that promote coordination, cooperation, and healthy competition among institutions while fostering robust teacher-student engagement and peer interactions. This model recognizes that improved access can lead to enhanced quality outcomes when supported by effective input- and process-oriented initiatives. Lastly, the Maximized Digital Substitution Funding Model (MDSM) aims to minimize costs by leveraging digital technologies and blended learning approaches. This includes creating digital replicas of high-performance institutions to efficiently scale quality and access. Additionally, directing public funds towards creating essential physical infrastructure that complements digital platforms is crucial, especially for marginalized communities' access to higher education and fostering research and innovation.

India's higher education funding landscape gradually aligns with the principles of the QDM, as evidenced by initiatives such as Performance-Based Budgeting and the Higher Education Financing Agency (HEFA). However, fully transitioning to QDM may take time. Therefore, a balanced approach combining elements of ADM and MDSM is recommended to simultaneously enhance access, quality, and cost-effectiveness in higher education. In conclusion, this study advocates a nuanced funding approach that integrates quality-driven investments, improved access strategies, and digital innovation to effectively propel India towards its fourth quadrant goal. By adopting a blend of these financing models, policymakers can steer higher education towards a more inclusive, high-quality, and financially sustainable future.

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