FORECAST AND EVOLUTION OF THE GROSS ENROLMENT RATIO IN PRIMARY EDUCATION IN INDIA

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Abhishek Kumar

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Supervised by

Ms. Aishani Pal

Delhi Technological University

Department of Economics,

University School of Management and Entrepreneurship

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DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering)

Shahbad Daulatpur, Main Bawana Road, Delhi-42

CANDIDATE'S DECLARATION

I **Abhishek Kumar** hereby certify that the work which is being presented in the thesis entitled

"**Forecast and Evolution of the Gross Enrolment Ratio in Primary Education in India**"

in partial fulfillment of the requirements for the award of the Degree of MA Economics, submitted in the Department of Economics (USME), Delhi Technological University is an authentic record of my own work carried out during the period from June, 2023 to May, 2024 under the supervision of Ms Aishani Pal.

The matter presented in the thesis has not been submitted by me for the award of any other degree of this or any other Institute.

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DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering)

Shahbad Daulatpur, Main Bawana Road, Delhi-42

CERTIFICATE BY THE SUPERVISOR

Certified that **Abhishek Kumar (2K22/MAE/36)** has carried out their search work presented in this thesis entitled **"Forecast and Evolution of the Gross Enrolment Ratio in Primary Education in India"** for the award of **MA Economics** from Department of Economics (USME), Delhi Technological University, Delhi, under my supervision. The thesis embodies results of original work, and studies are carried out by the student himself and the contents of the thesis do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

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Ms. Aishani Pal

Date: 4/06/24

Forecast and Evolution of the Gross Enrolment Ratio in Primary Education in India

Abhishek Kumar

ABSTRACT

The Sarva Shiksha Abhiyan is a comprehensive and Integrated flagship programme of the Government of India aimed at Universalization of elementary education which came to effect in November 2000.The concept of Universalization implies education to all children up to the age of 14, that is completion of the upper primary level of education. The dissertation wishes to study the evolution of the GER component in primary education, the improvement of which is an objective of the scheme. An analysis and forecast of the gross enrolment of girls and total gross enrolment in primary education has been taken about through the course of this study. It looks at the developments and studies factors that have influenced the Gross Enrolment Ratio. Increasing the gross enrolment was one of the aims of the policy along with other factors. The study forecasts that the gross enrolment ratio will increase. The predictions realized on the basis of the model obtained show a continuous increase of GER values in the next years. The results obtained can be a good starting point for any study which has as a theme the establishment of personnel policies in the educational system. While increasing pupil teacher ratios have helped in improvements, percentage of aggregate expenditure on education remained around the same mark for all states. Apart from gross enrolment ratio, other factors relating to the quality of education should be studied. Further studies should take into account the very recent policy change of strengthening the SSA by using teacher related factors for quality improvements. The identification and improvements in factors relating to the quality of education in different regions of India can help in meeting the objectives of Sarva Shiksha Abhiyan, the deadline to which has already passed.

Sarva Shiksha Abhiyan (SSA) is an innovative and integrated flagship programme launched by the Government of India during November 2000 to universalize elementary education. Universalization here means education for all children until age 14, which includes the upper primary level.

This dissertation attempts to examine the evolution of Gross Enrolment Ratio (GER) component in primary education since improving GER is one of the major objectives of the SSA programme. The present study analyses and predicts the girl's gross enrolment and overall gross enrolment in primary education.

During the span of this study, the trends and determinants of Gross Enrolment Ratio have been studied. It has been predicted that the gross enrolment ratio will also rise in the future. The future projections made through the realized model indicate that the value of GER will keep on increasing in the years to come.

The findings of this study may provide a firm base for any further study which concentrates on the formulation of personnel policies within the education system. Pupil-teacher ratios, although increasing, have played a positive part in improvement but the percentage of aggregate expenditure on education till date has shown more or less the same trend in all states. But, at the same time it should be kept in mind that besides the gross enrolment ratio, other considerations related to quality should also be examined. The future studies should consider the recent policy shift of strengthening the SSA by using teacher related factors to bring about improvement in quality.

The identification of quality related factors and their improvement across different regions of India would help in achieving the goals of Sarva Shiksha Abhiyan, even though the time schedule for its implementation has long been over.

The present study reveals that although there has been progress in raising the gross enrolment ratios, especially of girls, yet further improvement is possible on the counts of resource mobilization and quality education.

Moreover, the present study brings to the fore the relevance of regional differentials and the necessity of area specific interventions to tackle the problems unique to different regions of India. The identification of factors affecting the quality of education in specific regions would help in achieving the goals of Sarva Shiksha Abhiyan even though the time schedule for its implementation has long been over.

On the whole, the present dissertation accentuates the need for continuous assessment and reformulation of the policies in tune with the emerging needs of the country. The findings and recommendations of this study may serve as a handy guide for the policy makers, educators and other stakeholders in their sincere efforts to provide equitable and quality education to all the children of India.

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Finally, I thank God for granting me the health, perseverance, and wisdom to complete this journey.

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List of Symbols, Abbreviations and Nomenclature

- SSA – SARVA SHIKSHA ABHIYAN
- GER – GROSS ENROLMENT RATIO (FOR CLASSES 1 TO 5)
- NEP – NEW EDUCATION POLICY
- RTE – RIGHT TO EDUCATION
- GERF – GROSS ENROLMENT RATIO FEMALE (FOR CLASSES 1 TO 5)
- GERT – GROSS ENROLMENT RATIO FEMALE (FOR CLASSES 1 TO 5)
- ADF – AUGMENTED DICKY-FULLER TEST
- ACF – AUTOCORRELATION FUNCTION

Chapter I

Introduction and Background

I.1 Introduction to the Topic

The Sarva Shiksha Abhiyan (SSA) is a comprehensive program initiated by the Government of India with the aim of universalizing elementary education. Universalization of elementary education implies that all children, regardless of their social and economic backgrounds, have access to education until they complete the upper primary level. It was launched in November 2000. SSA program targets to enrol in primary education, children up to the age of 14 years.

The primary education system can be evaluated on the basis of a bunch of indicators. Participation and access to education can be evaluated on the basis of gross enrolment ratio, net enrolment ratio etc. The GER is a critical indicator in this context, as it measures the total enrollment in primary education, regardless of age, expressed as a percentage of the official primary school-age population. The primary gross enrolment ratio represents the percentage of children enrolled in primary education, regardless of age, in relation to the total population within the official age group.

The ratio can include children who are over or below the official age range of that group. It is because of early or late enrolments or for dropouts that come back to school. This is the reason as to why the GER can go beyond 100%.

The GER is a key indicator in evaluating conditions of enrolment in a country or area. Studying and forecasting its trends can help in medium- and long-term policymaking. It can also help in developing strategies in the area of human resources and particularly the education system. This can be helpful for stakeholders in developing targeted interventions, ensuring resource allocation, and closing the gaps in access and participation within the education system.

This dissertation is based on the annual primary GER values of India for the period of 1971-2022. The aim is to construct an econometric model based on the existing data, to validate the model and to forecast the GER values in the coming years. By representing the percentage of students enrolled in primary education relative to the total population within the official age group, one gets a comprehensive view of the educational system's reach and inclusiveness. The GER gives a fuller view of the level of coverage of the educational system, including both those within the official age group and those outside.

Through data-driven insights and predictive modelling, education authorities are empowered to make informed decisions, implement targeted strategies, and work for continued improvement of the educational system and ensure that no child is left behind in the race for knowledge and personal development.

I.2 Literature Review

I.2.1 - Progress and Challenges in Sarva Shiksha Abhiyan

Kainth (2000) explores the progress and identifies various challenges faced by the SSA across different states in India. The study highlights the efforts made since the program's inception and the hurdles encountered in achieving universal education. These include infrastructural deficits, inadequate teacher training, and socio-cultural barriers that prevent children, especially girls, from attending school regularly.

He highlights that despite progress, issues such as high dropout rates, teacher vacancies, untrained teachers, and inadequate teaching materials remain. The problem of the program facing challenges in achieving gender parity and addressing the educational needs of marginalized groups is also mentioned. The efforts to increase the participation of girls have been mentioned. The document highlights a need for improvement in monitoring, community involvement, and addressing factors affecting learner achievement. Some recommendations regarding maintaining funding arrangements, revising guidelines to optimize investment, and integrating early childcare education are given. The introduction of vocational education at the upper primary level is suggested.

Rao (2002) focuses on structural constraints within SSA schools, using the Sahibganj district of Jharkhand as a case study. This work emphasizes the challenges in economically and socially diverse settings, showcasing the disparities that exist in the educational infrastructure and resources available. Rao points out that in economically deprived regions, schools often lack basic facilities, which hampers the learning environment and deters regular attendance. The progress of the SSA is hindered by social and economic differentiation. Location of school and division of the place also affects attendance. She notes disparities in infrastructure and resources among different schools.

Mehta (2005) provides an in-depth analysis of the achievements in elementary education in India, citing data from the Ministry of Human Resource Development. This comprehensive study outlines the significant strides made towards universal education, such as increased enrollment rates and improved literacy levels, while also highlighting ongoing challenges like teacher absenteeism and resource allocation.

I.2.2 - Quality and Inequality in Indian Education

Velaskar (2008) discusses the historical context of the quality-equality conundrum in Indian education. The study suggests focusing on access, completion, and deprivation to address the inequalities prevalent in the system. Velaskar argues that while access to education has improved, the quality of education and the rate of completion still lag behind, particularly for marginalized communities. She draws historical perspective on how policy discourse has evolved under the influence of global and national political economies and how this has shaped educational opportunities for disadvantaged groups. She starts from the beginning in 1968 with the first NEP and argues that the policy implementation created a stratified education system which could not reduce inequalities. NEP 1986 marked a shift in policy discourse influenced by neo liberal ideologies. Talking of the contemporary landscape, it is argued that despite increased enrolment, significant inequalities persist. The paper concludes by suggesting a critical engagement with global discourses and also that the state should commit to equitable and high-quality public education for all.

Harris (2010) acknowledges the remarkable progress made in elementary education despite historical neglect. He discusses under-resourced education systems and proposes three quick fixes: hiring teachers and contract teachers, encouraging community participation, and privatization to improve the status of elementary education in India. He acknowledges the RTE act in increasing the enrolment but the concerns about the quality of education remains. The paper highlights the need for a bottom-up approach. It concludes with suggestions for experimenting with teaching methods tailored to the needs and requirements of children. Harris emphasizes the importance of localized solutions and the need for flexibility in educational approaches to cater to diverse student populations.

I.3 Gaps in Literature

Despite significant research on various aspects of the SSA and elementary education in India, there are notable gaps. One major gap is the lack of studies on the evolution of factors such as the Gross Enrollment Ratio (GER) and pupil-teacher ratios over time. While the GER has shown steady growth since the 1970s, minimal research has been done to acknowledge or study this phenomenon comprehensively.

Additionally, forecasting as a tool for directing public policy in education has been largely unexplored. Given that qualitative changes in India are relatively recent, this might explain the lack of research. However, studying these trends is essential for a better understanding of their implications and for formulating effective policies.

Chapter II

Objectives and Methodology

II.1 - Proposed Objectives

This dissertation aims to study the annual values of GER in primary education in India from 1971 to 2022. The objective is to build an econometric model based on these data, validate it, and make predictions about the GER's evolution, focusing on both girls' enrollment and total enrollment for the next ten years.

The specific objectives of this study are:

1. Analyse the historical evolution of GER: Understanding how the GER has changed over the past five decades.

2. Evaluate the consistency of the GER trend: Assessing whether the increase in GER has been steady and identifying any periods of stagnation or decline.

3. Forecast future GER trends: Using historical data to predict GER trends for the next decade.

4. Compare trends in girls' enrolment versus total enrolment: Investigating if the initiatives have differentially impacted gender-specific enrollment rates.

II.2 - Data Sources

The data for this study are sourced from:

- Unified District Information System for Education (UDISE): This provides comprehensive data on various parameters of education at the district level in India.

- The World Bank Database (data.worldbank.org): This offers global education statistics and provides a comparative perspective on India's performance. https://data.worldbank.org/indicator/SE.PRM.ENRR.FE?locations=IN

- Open Government Data (OGD) platform (data.gov.in): This platform provides access to a wide range of government data, including educational statistics.

These data sources offer robust and reliable data that form the backbone of the analysis conducted in this dissertation.

Year	GERF	GERT
1971	59.9352417	77.41378784
1972	60.87042999	78.40390778
1973	64.0004425	81.73573303
1974	63.66329956	81.21514893
1975	64.34275055	81.904953
1976	64.26966095	81.42256927
1977	66.46394348	83.98291016
1978	62.86199188	80.22691345
1979	63.50550842	80.0406723
1980	64.7634964	81.32977295
1981	66.17185211	82.58339691
1982	66.84510803	83.41538239
1983	69.03092194	85.47731018
1984	70.76650238	87.32562256
1985	71.82553101	87.41472626
1986	74.97009277	89.60289764
1987	74.08351135	87.54055023
1988	75.7292099	89.0692215
1989	77.41670227	92.2303009
1990	77.63540649	91.64842987
1991	78.69963074	91.30232239
1992	79.70426941	91.79192352
1993	82.87548065	93.39665222
1994	84.21269226	94.3418808
1995	83.67635345	93.6837616
1996	83.7161026	93.17089844
1997	83.82222748	92.8254776
1998	82.69792938	91.30761719

1999	83.22833252	91.82457733
2000	84.83673096	93.32395172
2001	84.86740112	92.7808609
2002	86.14808655	93.08487701
2003	98.98893738	100.7741394
2004	98.98893738	102
2005	98.98893738	104
2006	98.98893738	106
2007	106.6591263	107.9235687
2008	108.5473175	108.3117065
2009	107.7694626	106.9168015
2010	107.1264038	106.5515137
2011	104.8029099	103.9550171
2012	108.9378433	107.7708817
2013	108.9378433	102.5175705
2014	101.5931473	101
2015	102.227211	100.7127686
2016	101.774765	100.2540359
2017	101.774765	100
2018	98.53240967	97.59329987
2019	96.95188141	96.11712646
2020	98.77374268	97.9693222
2021	99.9630661	99.39272308
2022	108.3433533	108.1451721
2023	108.3433533	108

Tab II.1 - Data Table

II.3 - Methodology

The methodology involves several key steps:

1. Research the Evolution of the GER: Analyse how the GER has changed over the last 50 years. This involves plotting the historical data and identifying key trends and turning points.

2. Study the Consistency in the Trend: Examine the stability and consistency of the GER trend. Statistical tools like autocorrelation and partial autocorrelation functions will be used to assess the persistence of the trend.

3. Forecast the GER: Use the available time series data to forecast the GER for the next ten years. This will involve fitting a suitable time series model to the data.

4. Plot the Data Using R Software: Utilize R software to visualize the data and forecast. R provides powerful tools for statistical analysis and visualization, which will be essential for this study.

5. Apply the ARIMA Model: Use the ARIMA (Autoregressive Integrated Moving Average) model for predicting future trends in GER. The ARIMA model is particularly well-suited for time series forecasting because it can handle data with trends and seasonality.

Chapter III

Features of the data and Model

III.1 - The GER(Female) time series

The mean of the gross female enrolment ratio in primary education is 85.37 with a standard deviation of 16.28. The minimum value for the Gross enrolment was 59.935 in the year 1971 and the maximum till 2022 has been 108.93 in the year 2013.

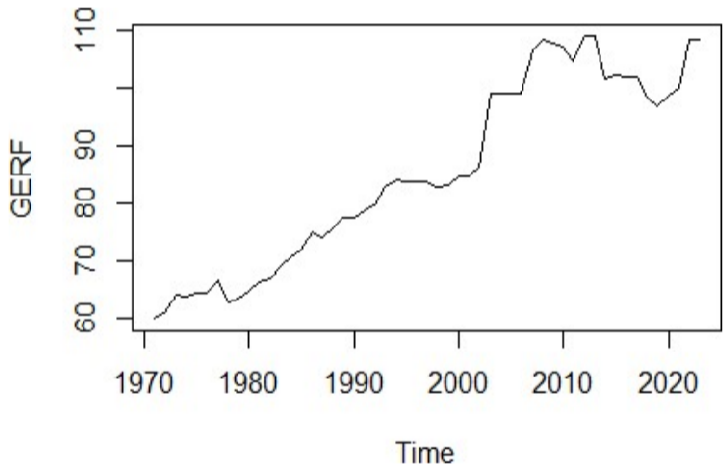

Fig III.1- Graph of the Time Series GER (Female) values

To check if the data is correlated or not, the following graph can be viewed:

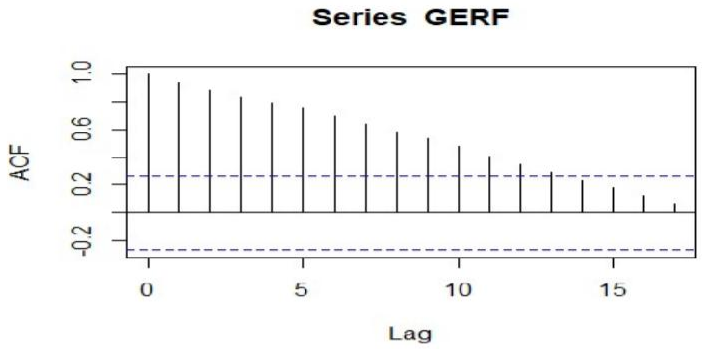

Fig. III.2 - GERF autocorrelation graph

The graph suggests that there is autocorrelation. With regards to the variance, the graph does signal as to whether it is unstable or not. The series by looking seems non stationary. To detect non-stationarity in the plot, ADF test can be used. The null hypothesis of the ADF test is that the series is not stationary. The level of significance is fixed at 0.05.

The results of the test after running the ADF test in R program are as follows:

```
        Augmented Dickey-Fuller Test

data:  GERF
Dickey-Fuller = -1.9528, Lag order = 3, p-value = 0.5935
alternative hypothesis: stationary
```

Test III.1 - Augmented Dickey-Fuller test for GERF

Here, the p-value (0.5935) is **relatively high**, meaning it's **not statistically significant** at the conventional 5% level. In the context of a Dickey-Fuller test, this suggests that:

We **fail to reject the null hypothesis** of a unit root (non-stationarity) in the data.

There's **not enough evidence** to conclude that the data is stationary based on this test.

Suggesting that the data is non-stationary.

III.2 - The GER(Total) time series

The mean of the total enrolment ratio in primary education is 93.63 with a standard deviation of 9.164. The minimum enrolment was 77.41 in the year 1971 and the maximum enrolment was 108.31 in the year 2008.

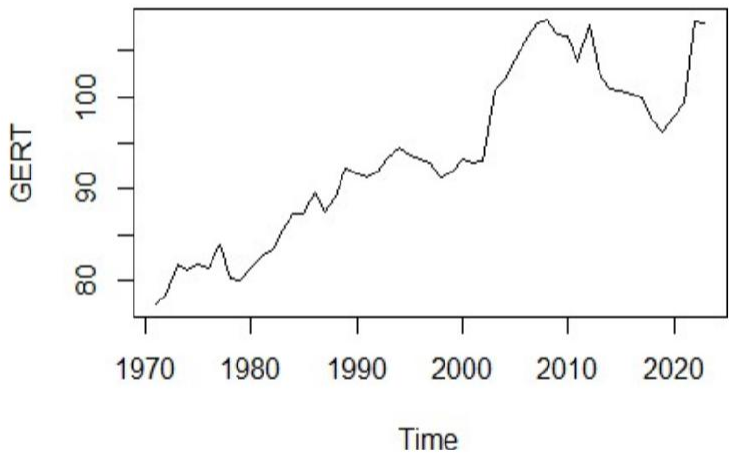

Fig III.3 - Graph of the time series GER(Total) values

The Autocorrelation graph is as follows:

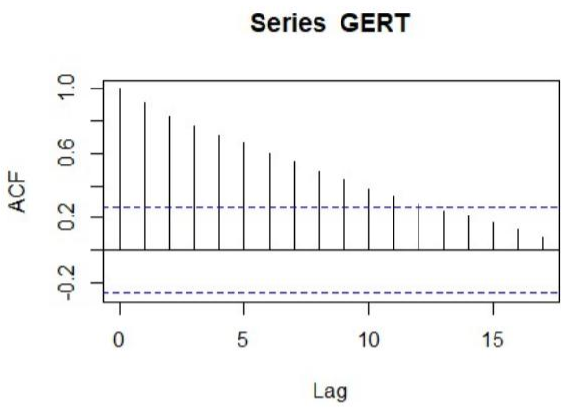

Fig III. 4 - GERT autocorrelation graph

The results of the ADF test are as follows suggesting that there is non stationarity.

```
        Augmented Dickey-Fuller Test

data:  GERT
Dickey-Fuller = -2.9144, Lag order = 3, p-value = 0.2064
alternative hypothesis: stationary
```

Test III.2 - Augmented Dickey-Fuller test for GERT

Here, the p-value (0.2064) is **relatively high**, meaning it's **not statistically significant** at the conventional 5% level. In the context of a Dickey-Fuller test, this suggests that:

We **fail to reject the null hypothesis** of a unit root (non-stationarity) in the data.

There's **not enough evidence** to conclude that the data is stationary based on this test alone.

III.3 - Selection of the Best Model

The GER time series data is not stationary, which means it has trends over time. To make the series stationary, we apply a first-order differencing transformation. The best suited model would be an ARIMA (0,1,0) with drift. To select the model best suited, software package R has been used which has the function auto.arima in the library forecast. From a list of candidate models, the best suited model can be chosen which has the minimum AIC statistic.

```
> GREFMODEL= auto.arima(GREF,ic="aic",trace= TRUE)

 ARIMA(2,1,2) with drift         : Inf
 ARIMA(0,1,0) with drift         : 261.0559
 ARIMA(1,1,0) with drift         : 263.0552
 ARIMA(0,1,1) with drift         : 263.0551
 ARIMA(0,1,0)                    : 264.2733
 ARIMA(1,1,1) with drift         : 265.0143

 Best model: ARIMA(0,1,0) with drift
```

Test III.3 – Best ARIMA model for GERF

```
> GRETMODEL= auto.arima(GRET,ic="aic",trace= TRUE)

 ARIMA(2,1,2) with drift         : Inf
 ARIMA(0,1,0) with drift         : 238.1961
 ARIMA(1,1,0) with drift         : 240.185
 ARIMA(0,1,1) with drift         : 240.1869
 ARIMA(0,1,0)                    : 239.4901
 ARIMA(1,1,1) with drift         : 242.1395

 Best model: ARIMA(0,1,0) with drift
```

Test III.4 – Best ARIMA model for GERT

The ARIMA (0,1,0) model with drift is specified as:

$$GER_t = GER_{t-1} + \mu + \varepsilon_t$$

Where:

GER t is the Gross Enrolment Ratio at time t

Mu is the drift term (constant)

Epsilon t is the error term at time t

This model implies that the GER at any time t is equal to the GER at the previous time (t-1), plus a constant drift term and a random error term.

consider ARIMA (0,1,0) with drift
Here, p = 0, indicating the model doesn't rely on past values of the series itself for prediction.
d = 1 implies the data needs to be differenced once.
Here, q = 0, meaning the model doesn't incorporate past errors.
The term "drift" signifies that the ARIMA model incorporates a constant term to account for a linear trend in the data.

This model can be used for both GERF and GERT time series data.

III.4 - Validation of the model

Two methods namely the:

(i) ACF test
(ii) Lung-Box test

were employed to validate the model

The results of the tests are given as follows:

I. For GERF Model:

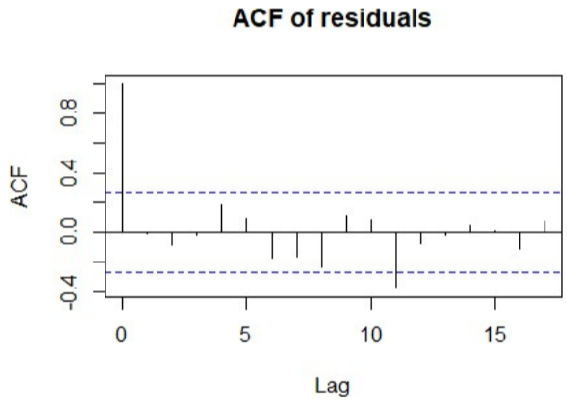

Fig III.5 - ACF of the residuals (GERF)

```
        Box-Ljung test

data:  GREFMODEL$residuals
X-squared = 0.0006797, df = 1, p-value = 0.9792
```

Test III.5 Box-Ljung autocorrelation test

II. For GERT model

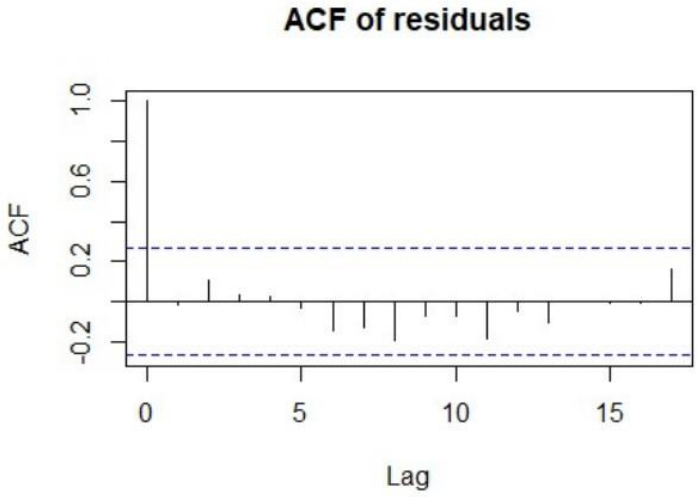

Fig III.6 - ACF of the residuals (GERT)

```
        Box-Ljung test

data:  GERTMODEL$residuals
X-squared = 0.011923, df = 1, p-value = 0.9131
```

Test III.5 – Box- Ljung autocorrelation test

Chapter IV

Forecast and Further discussion

IV.1 - Forecast of the GERF values

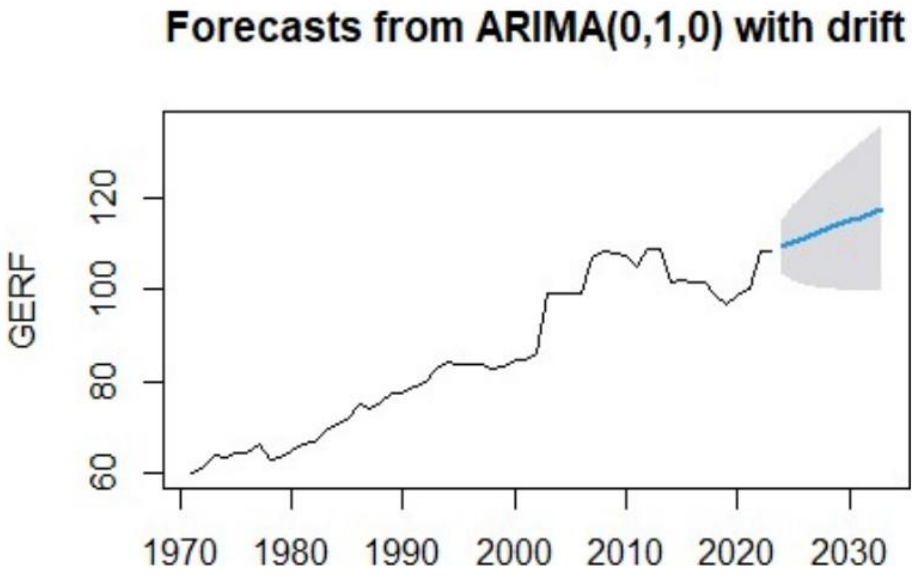

Fig IV.1 - Forecast of GERF for the next 10 years

	Point Forecast	Lo 95	Hi 95
2024	109.2743	103.60313	114.9454
2025	110.2052	102.18499	118.2254
2026	111.1361	101.31341	120.9588
2027	112.0671	100.72476	123.4094
2028	112.9980	100.31691	125.6791
2029	113.9289	100.03748	127.8203
2030	114.8598	99.85538	129.8643
2031	115.7908	99.75032	131.8312
2032	116.7217	99.70823	133.7351
2033	117.6526	99.71886	135.5864

Tab IV.1 - GERF forecast table

IV.2 - Forecast of the GERT values

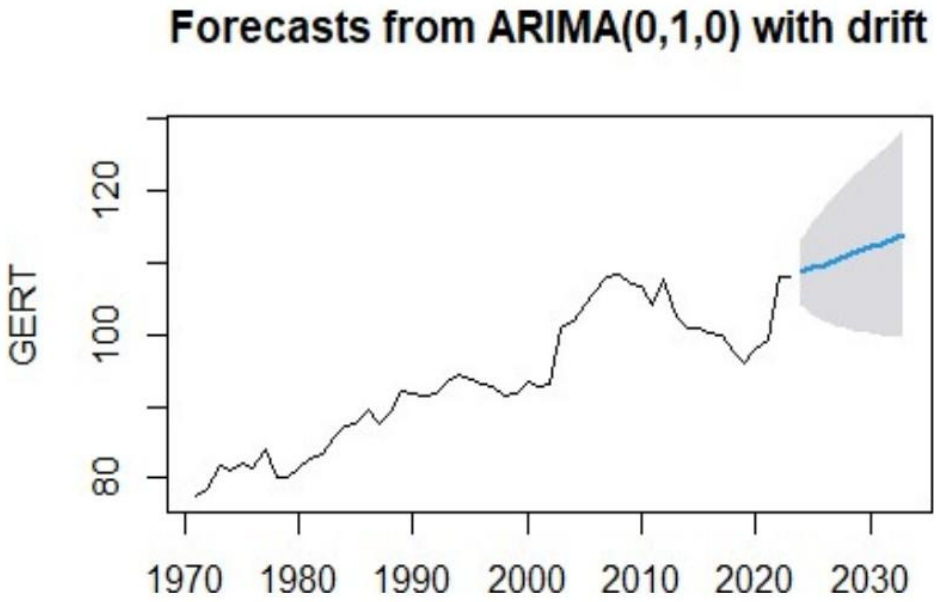

Fig IV.2 - Forecast of GERT for the next 10 years

	Point Forecast	Lo 95	Hi 95
2024	108.5882	104.03608	113.1403
2025	109.1764	102.73873	115.6141
2026	109.7646	101.88009	117.6491
2027	110.3528	101.24855	119.4570
2028	110.9410	100.76214	121.1198
2029	111.5292	100.37881	122.6795
2030	112.1174	100.07360	124.1611
2031	112.7056	99.83024	125.5809
2032	113.2938	99.63741	126.9501
2033	113.8820	99.48690	128.2770

Tab IV.2 - GERT forecast table

IV3 - Research Findings and Forecast

The time series data of GER for female children in India, collected over 50 years, was found to be non-stationary. However, the trend shows a steady increase, indicating improvements in the GER over time. This suggests that policies aimed at increasing female enrollment have been effective.

For the total GER, similar upward trends were observed. This indicates that overall enrollment in primary education has increased, reflecting the success of various educational initiatives.

The forecast for the next ten years predicts a continuous increase in GER values. Specifically, for girls in primary education, the GER is expected to rise to approximately 117.65 by 2033. The overall GER for primary education (classes 1 to 5) is projected to increase to around 113.88 by the same year.

IV.4 - Discussion

The steady increase in the enrolment ratio highlights the success and dedication of policymakers in implementing schemes like the Sarva Shiksha Abhiyan. Ensuring that children attend school involved addressing various challenges, such as improving the quality of education, providing incentives, increasing expenditure, and ensuring regular attendance.

A specific challenge was the lower enrolment of girls, partly due to the lack of dedicated toilets for female students. This issue has been addressed in recent years through initiatives like the Swachh Bharat Abhiyan, which focuses on building toilets and improving sanitation facilities in schools.

The increase in GER indicates that these efforts are yielding positive results. However, it is essential to continue monitoring and addressing other potential barriers to education, such as economic constraints, cultural attitudes, and infrastructural deficiencies.

The GER, which in the forecast seems to shoot above 100 might seem difficult to comprehend at first but the reason for it going above is that children who are out of the predefined age bracket are also enrolled in the primary classes. Nevertheless, the increasing numbers is only good news.

Chapter V

Conclusion and Policy Implication

The forecasts based on the model predict a continuous increase in GER values over the next decade. For girls in primary education, the GER is expected to rise to approximately 117.65 by 2033. The overall GER for primary education (classes 1 to 5) is projected to increase to around 113.88 by the same year.

These findings suggest that initiatives like the Sarva Shiksha Abhiyan are having a positive impact on primary education in India. Continued efforts and targeted interventions will be necessary to maintain this positive trend and address any remaining challenges.

Recent years have witnessed improved coverage and output. This has led to an increasing GER. An upward movement of GER which is forecasted to increase will hopefully lead to the achievement of the designated goal of providing education to every child.

The quality of education can also be increased which depends on the commitment of the government. Technology and investing more in the education sector should be government's goal after the increase in numbers.

Policy Implications

The results of this study can serve as a foundation for policies and practices related to the hiring, training, compensation, and overall management of teachers and other educational staff in India. Additionally, these findings may prompt further research into specific areas of personnel policies or workforce preparation, contributing to the continuous improvement of the education system.

Effective policy measures might include:

(i) Increasing Investment in Educational Infrastructure: Ensuring that all schools have adequate facilities, including classrooms, libraries, and sanitation facilities.
(ii) Enhancing Teacher Training Programs: Providing ongoing professional development for teachers to improve the quality of education.
(iii) Implementing Targeted Interventions for Marginalized Groups: Designing programs specifically aimed at increasing enrolment and retention rates for girls and children from economically disadvantaged backgrounds.
(iv) Promoting Community Participation: Encouraging greater involvement of local communities in the management and operation of schools to ensure accountability and responsiveness to local needs.

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