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HUMAN CAPITAL FORMATION IN INDIA AND KARNATAKA: A TIME SERIES ANALYSIS OF GDP, EDUCATIONAL EXPENDITURE, AND HIGHER EDUCATION ENROLMENT

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INTRODUCTION:

Human capital formation is a long-run process and determined by many factors. The investment in education and wealth of the nation are the two important factors have been influenced the capital formation of a country or territory. In the present chapter, Gross Domestic Product (GDP) of India has been treated as wealth of the nation for India level analysis and Gross State Domestic Product (GSDP) of Karnataka has been treated as wealth of Karnataka (Becker, 1964, 1975 & 1993). Expenditure on education by centre, all states and overall expenditure in India are treated as investment in education in India. Expenditure on higher education and overall expenditure on education by Government of Karnataka (GOK) is treated as Investment in education in Karnataka. Enrolment in higher education in India is treated as human capital formation in India and enrolment in higher education in Karnataka is treated as human capital formation in Karnataka. The first part of the chapter deals with human capital formation in India and second part of the chapter deals with human capital formation in Karnataka.

HUMAN CAPITAL FORMATION IN INDIA:

The following variables are used for the analysis of human capital formation in India.

- Gross Domestic Product (GDP) of India (In Crore at constant prices)
- All States Expenditure on Education in India (ASEEI) (In Crore at current prices)
- Government of India Expenditure on Education in India (GOIEEI) (In Crore at current prices)
- Overall Expenditure on Education in India (OEEI) (In Crore at current prices)
- Male Enrolment in Higher Education in India (MEHEI) (In Numbers)
- Female Enrolment in Higher Education in India (FEHEI) (In Numbers)
- Total Enrolment in Higher Education in India (TEHEI) (In Numbers)

RESEARCH METHODOLOGY

The study employs a **quantitative research design** using **time series secondary data** to examine the relationship between GDP, educational expenditure, and enrolment in higher education in India.

1. **Data Source:**
    - Economic Surveys of India
    - Ministry of Education, Government of India

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2. **Time Period:**
    - Covering multiple years (as per data availability in Economic Surveys and Educational Statistics).
3. **Variables Used:**
    - **GDP** – Gross Domestic Product of India
    - **ASEEI** – Aggregate State Expenditure on Education in India
    - **GOIEEI** – Government of India Expenditure on Education in India
    - **OEEI** – Overall Expenditure on Education in India
    - **MEHEI, FEHEI, TEHEI** – Male, Female, and Total Enrolment in Higher Education
4. **Statistical Techniques Applied:**
    - **Trend Analysis** (Compound Annual Growth Rate, significance testing)
    - **Stationarity Tests** (Augmented Dickey-Fuller test)
    - **Co-integration Analysis** (Johansen Co-integration test)
5. **Rationale for Methods:**
    - **Trend analysis** helps capture long-run growth patterns.
    - **ADF test** ensures variables are stationary to avoid spurious regression.
    - **Co-integration analysis** establishes whether a long-run equilibrium relationship exists between educational expenditure and human capital formation.

Trend Analysis:

The trends in the variables selected for the analysis of human capital formation is presented in the following section.

Trends in GDP and Expenditure on Education in India

(In %)

Sl. No.	Variable	CAGR	Std Error	t-Value	P-Value
1	GDP	12.34	0.003	47.08	0.000***
2	ASEEI	13.28	0.004	32.04	0.000***
3	GOIEEI	15.93	0.006	25.62	0.000***
4	OEEI	13.81	0.004	34.81	0.000***

Source: Economic Surveys of India and Ministry of Education, GOI

The trends in GDP and expenditure on education in India are presented above. It is found that growth rates are significant at one percent level. Accordingly, growth rates of expenditure on education have been increased slightly at higher rate compared to growth of GDP in India. The following graphs show trends in GDP and expenditure on education in India.

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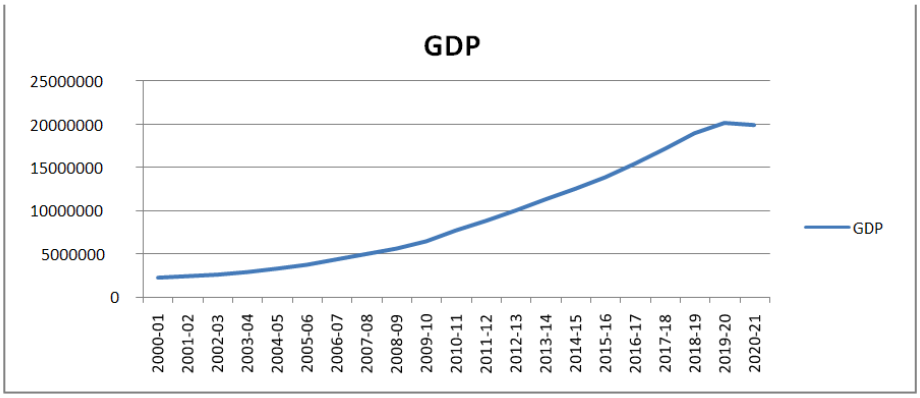
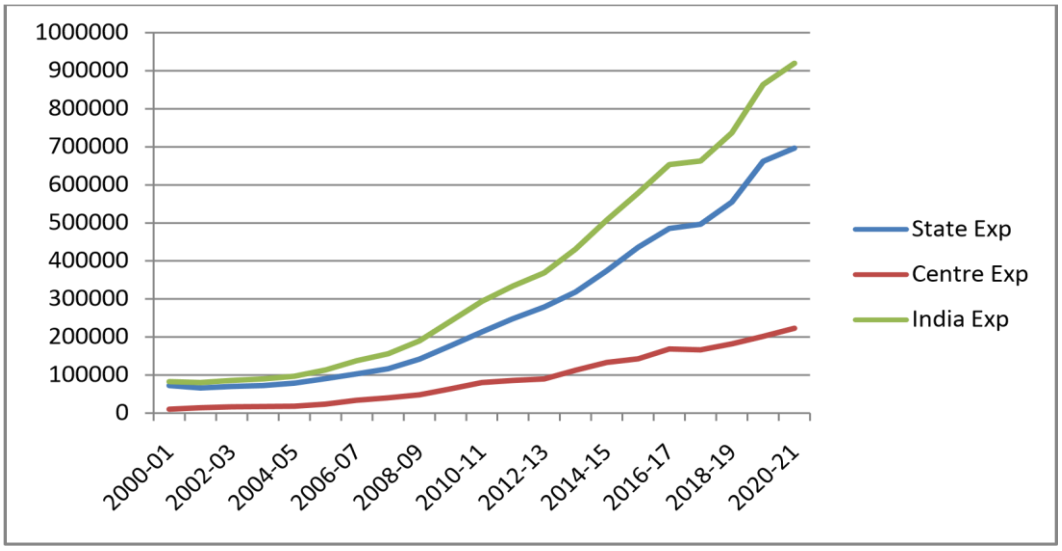
1: Trends in GDP



1b: State, Central and India Expenditure



Trends in Enrolment in Higher Education in India

(In %)

Sl. No.	Variable	CAGR	Std Error	t-Value	P-Value
1	MEHEI	7.02	0.004	16.45	0.000***
2	FEHEI	9.85	0.005	20.68	0.000***
3	TEHEI	8.23	0.004	19.07	0.000***

Source: Economic Surveys of India and Ministry of Education, GOI

The trends in enrolment in higher education in India are presented above. It is found that growth rates are significant at one percent level. Accordingly, growth rate of female enrolment in higher education has been increased at higher rate compared to growth rate of male enrolment in higher education in India. The following graphs show trends in higher education in India.

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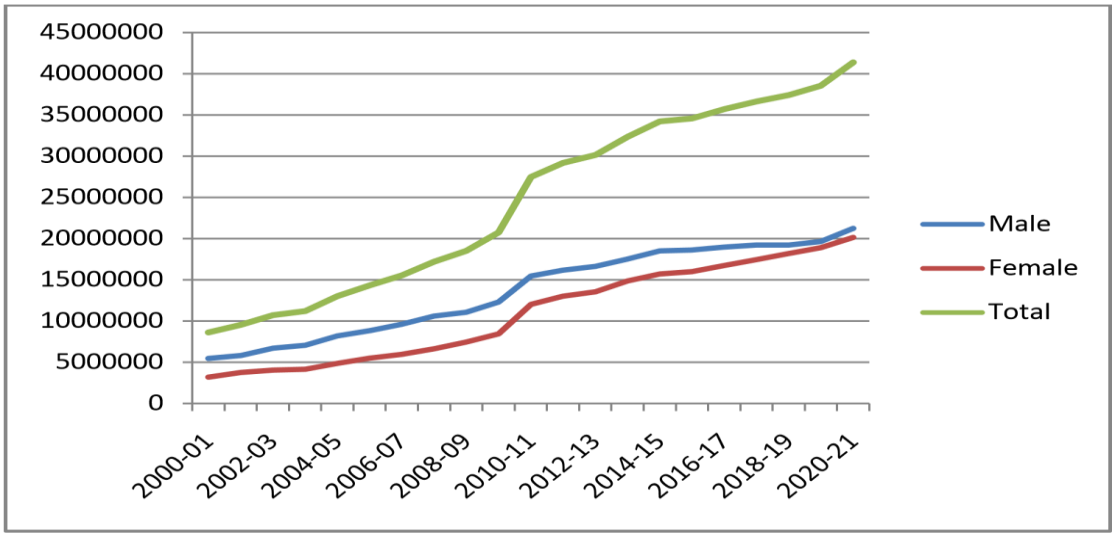
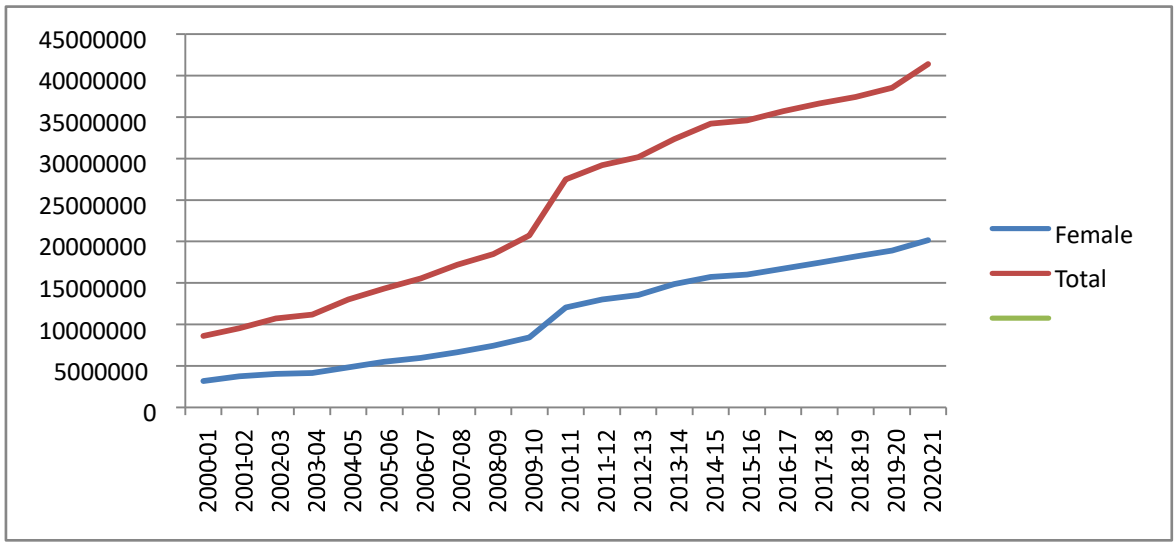
1c: Male ,Female and Total Enrolment



1d: Female Enrolment



Analysis of Stationarity: Analysis of stationarity is imperative for time series data. Using non-stationary data leads to spurious results. Accordingly, the times series data used in the present chapter are checked for stationarity with the following three models. The Augmented Dickey Fuller (ADF) procedure followed for checking the stationarity of data.

The test was conducted with three types of models;

1. without intercept and trend ($\Delta y_t = y_{t-1} + e_t$)
2. with intercept ($\Delta y_t = \alpha + y_{t-1} + e_t$)
3. with intercept and trend ($\Delta y_t = \alpha + y_{t-1} + T + e_t$)

The ADF test was conducted with level, first and second difference data. The results of the test are presented below;

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ADF Test for Stationarity GDP and Expenditure on Education

Sl. No.	Variables	t-statistic	P-value	Level	Model
1	GDP	-6.032	0.001	*I ~ (1),*	$\Delta y_t = a + by_{t-1} + T + e_t$
2	ASEEI	-7.666	0.000	*I ~ (1),*	$\Delta y_t = a + by_{t-1} + T + e_t$
3	GOIEEI	-3.358	0.026	*I ~ (1),*	$\Delta y_t = a + y_{t-1} + e_t$
4	OEEI	-3.316	0.019	*I ~ (1),*	$\Delta y_t = a + y_{t-1} + e_t$

Source: Economic Surveys of India and Ministry of Education, GOI **Note:**

I ~ (1) means integrated of order one; the variable stationary at first difference.

The results of unit root are presented above. It is found that all the four variables are non-stationary at level data and found stationary at first difference. Accordingly, the above mentioned variables have been transformed to first difference and then used for further analysis.

ADF Test for Stationarity of Enrolment

Sl. No.	Variables	t-statistic	P-value	Level	Model
1	MEHEI	-3.443	0.026	*I ~ (1),*	$\Delta y_t = a + by_{t-1} + e_t$
2	FEHEI	-3.519	0.019	*I ~ (1),*	$\Delta y_t = a + by_{t-1} + e_t$
3	TEHEI	-3515	0.019	*I ~ (1),*	$\Delta y_t = a + y_{t-1} + e_t$

Source: Economic Surveys of India and Ministry of Education, GOI

Note:

I ~ (1) means integrated of order one; the variable stationary at first difference.

The results of unit root are presented above. It is found that all the three variables are non-stationary at level data and found stationary at first difference. Accordingly, the above mentioned variables have been transformed to first difference and then used for further ordinary least square analysis. Otherwise Johansen cointegration analysis is suitable for long-run equilibrium analysis.

5.1.3 Co-integration Analysis:

The co-integration analysis is applied for establishing the long-run stable relationship between wealth and capital formation in the following section.

Hypothesis 4:

H_0: There is no long-run relationship between investment in education and human capital formation.

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Co-integration between Expenditure on Education in India and Total Enrolment in Higher Education in India

Trend assumption: No deterministic trend

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen-value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.470172	14.97847	12.32090	0.0175
At most 1	0.141989	2.909631	4.129906	0.1042

Trace test indicates 1 co -integrating eqn(s) at the 0.05 level

Source: Economic Surveys of India and Ministry of Education, GOI

The Johansen co-integration test used to establish the long-run relationship between expenditure on education in India and total enrolment in higher education in India. The Trace indicates one co-integrating equation at five percent level of significance. Accordingly, there is long-run, stable and equilibrium relationship between expenditure on education in India and total enrolment in higher education in India. Hence, ***there is long-run relationship between investment in education and human capital formation. Accordingly, the null hypothesis is rejected and alternative hypothesis is accepted.***

Findings

1. **Growth in GDP and Education Expenditure**
   - GDP grew at **12.34% CAGR**, while education expenditure (state, central, and overall) grew at **higher rates (13–16%)**.
   - This indicates a **slightly stronger emphasis on educational investment** compared to overall economic growth.
2. **Growth in Higher Education Enrolment**
   - Male enrolment (MEHEI) grew at **7.02%**, female enrolment (FEHEI) at **9.85%**, and total enrolment (TEHEI) at **8.23%**.
   - **Female enrolment increased faster than male enrolment**, suggesting progress in gender inclusivity.
3. **Stationarity Analysis**
   - All variables were **non-stationary at level** but became **stationary at first difference [I(1)]**.
   - This validates the use of co-integration analysis.
4. **Co-integration Analysis**
   - Johansen Co-integration Test revealed **one co-integrating equation at 5% significance level**.

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- This confirms a **long-run equilibrium relationship** between expenditure on education and higher education enrolment in India.

SUGGESTIONS

1. **Increase Public Investment in Education:**
   - Despite positive growth, India's education expenditure as a share of GDP remains lower than global benchmarks. A higher allocation is necessary to sustain enrolment growth and improve quality.
2. **Focus on Female Education:**
   - Since female enrolment is rising faster, targeted **scholarships, safety measures, and skill-development programs** should be introduced to sustain momentum.
3. **Improve State-Level Equity:**
   - Ensure **balanced expenditure** across states to reduce regional disparities in higher education access.
4. **Promote Quality Alongside Quantity:**
   - With enrolments rising, focus should also shift to **faculty development, research infrastructure, and employability skills**.
5. **Strengthen Monitoring and Evaluation:**
   - Regular assessment of education expenditure outcomes should be institutionalized for **evidence-based policy decisions**.

CONCLUSION

The study demonstrates that **educational expenditure in India has consistently outpaced GDP growth**, reflecting the increasing importance placed on human capital development. Enrolment in higher education has grown significantly, with **female enrolment rising faster than male enrolment**, indicating progress toward gender inclusivity.The **stationarity and co-integration analysis** confirms a **long-run equilibrium relationship** between educational expenditure and higher education enrolment, establishing that **investment in education contributes significantly to human capital formation** in India.Therefore, policy initiatives should continue to strengthen educational financing, enhance inclusivity, and ensure quality outcomes to maximize the role of education in fostering sustainable economic growth.

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