Econometric analysis of Contribution of Education to Economic Growth of India and Odisha

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Abstract

Purpose: Human Capital Index Report ranked India 115 out of 157 countries (2019). Niti Aayog has accepted that about 35 percent of Indian graduates are not employable (Strategy for New India @ 75, 2018). The current study tries to study the contribution of education to economic growth in the post New Economic Policy (1991) era.
Method: The study uses secondary data on Gross (State) Domestic Product, population and public expenditure on education. Johansen cointegration is used to study the long run relationship and Vector Error Correction model is used to test the short run relations.
Finding: Central and state governments, with increase in population over time, increased their public spending on education. Both Fully Modified Ordinary Least Square method adopted for India and Dynamic Ordinary Least Square method adopted for Odisha showed that public expenditure on education has positive impact on economic growth of a nation.
At India (country) level and at Odisha (state) level economic growth and education have long run relation (Johansen Cointegration Test) but no short run relationship (VECM). The findings hold up to the issue of unemployability among Indian graduates and low HDI score of 0.44 in 2019.
Policy Implication: Indian education is more outcome oriented than output oriented. The dichotomy between vocational education and general education needs to be dissolved. Adding skill befitting to knowledge is the need of the hour.

Key Words: Public expenditure on education, GDP, Population, Cointegration, VECM

Introduction

Economic growth of an economy depends on its three sectors - Agriculture, Manufacturing and service sector. Education can lead to increase in agricultural output by removing ignorance and thus obtain, assess, and use information in taking advantage of existing opportunities, towards maximizing yield (Lockheed, Jamison and Lau, 1980). Education helps farmers in risk avoiding and encourages innovation (Knight, Weir and Woldehanna, 2003).

Solow (1957) studied the US economy from 1909 to 1949 and pointed out that "improvements in the education of the labor force" as one of the factors for economic growth. Bennett (1967) collected data from 70 countries and found that vocational education equips students with skill which provide jobs immediately. On the other hand, general education equips students with general education for the future. Okoh (1980) believes that productivity improves when the labour force is educated and trained.

In the service sector education helps in building a strong base of human capital by reducing underutilization of human resources (Bolino, 1968). Educated people considered education as a stepping stone for more jobs in competitive world (Anosike, 1977) because education improves thinking process (Goldin & Katz, 1999(a); Goldin & Katz, 1999(b); Goldin & Katz, 1999(c); Temple, 2001), and efficient adaptability to new technology (Levin, 1998; Bloom, 2005).

Relation between Education and Economic Growth

Numerous studies across the world have revealed that education and economic growth have a positive relation. Education has positive and significant effect on the growth rate of per capita income in African countries (Teal, 2011; Gyimah et. al,, 2006; Ajakaiye & Kimenyi, 2011). Many studies in USA and UK (McMahon & Oketch, 2013; Baldwin & Borrelli, 2008), Canada (Vaillancourt, 1995), and Brazil (Patrick and Kehrberg, 1973) found that education had positive relation with economic growth, specifically elementary education. Curle (1964) suggested there was a high correlation between per capita income and the percentage of national income invested in education. Many European (Psacharopoulos, 2009) countries like Spain (Carliner, 1976), Sweden (Bhuller et al, 2017), Hungary (Varga, 1995), Czech Republic and Slovak (Chase, 1998) too experienced positive contribution of education to economic growth.

But not all studies found that education and economic growth have a positive relation. Li and his friends (2005) said "China stands out as having one of the lowest rates of return in the world-far below Africa, Latin America and Asia" (Li, Brauw, Rozelle and Zhang, 2005, page-420), also similar results were found again by Li in 2008. Jann (2005) observed that returns to education are higher in the market sector than in the state sector in China. In China primary education has higher contribution to economic growth compared to secondary education (Chao & Dahu, 2017). Amornthum and Chalamwong (2001) noted that rates of return of most levels for male are on the wane (weaker), except at the university level in Thailand. The rates of return of the upper secondary and diploma levels have decreased over time. Idrus and Cameron (2000) studied Malaysian economy and concluded that "the returns to education declined for the university level".

Objective

Results derived across many Asian countries showed mixed response. Keeping this in mind the current study makes a modest attempt to critically analyse the contribution of education to economic growth in India and particularly in a developing state like Odisha.

Data and Method

From past literature, a list of variables, mostly used by researchers all over the world, has been enlisted for measuring the contribution of education to economic growth. Based on the availability of the data and the requirement of current research the variables that were selected for the present study are: Gross (State) Domestic Product at market price, public expenditure on education and population. The reasons for selecting public sector expenditure are: Firstly private sector education became a major player only after 2007. Secondly, there is a lack of organized data on expenditure undertaken by private educational institutes in India.

Expenditure on education, here, refers to total expenditure by all sectors in education confined to Revenue account (` in crore) which includes both Plan and Non Plan expenditure, budgeted by the education departments of the States/UTs and the Centre. It includes expenditure on education by Education Department and expenditure on education by Education and other departments. The expenditure of other departments includes the expenditure by Defense, Social Justice and Empowerment, Labour and Employment, Culture, Tribal Development, Ministries of Railways, Development of North Eastern Region and Department of Women and Child Development.

The data on population of India is collected once in 10 years by Census Operation of India. For the current purpose the decadal data is converted into their annual value using exponential method. It is computed by using the following formula: Pt = Poent . Where Pt = Final value of the variable ; Po = Initial value of the variable ; n = Growth rate per annum ; t = Time and e = Base of the natural logarithm.

The study uses secondary data collected from Reserve Bank of India website. The time period of the study is from 1995 to 2016 for calculating in contribution of education to economic growth India and from 1999 to 2016 for Odisha. All variables have been transformed to its natural log to avoid scaling problem and for stabilizing variances.

The level data when observed had shown the existence of a trend (Mitra & Rout, 2018). So while performing the Augmented Dickey Fuller test for unit root test (stationarity test), trend and intercept has been included in the equation.

Since all the three variables are stationary at their first difference indicating the same order of integration, thus Johansen cointegration method has been used to study the long run relationship. After obtaining the results and the statistical suitability, Vector Error Correction model has been used to test the short run relations.

Fully Modified Ordinary Least Square Method (FM-OLS) is used to estimate and predict the impact of education on economic development variables for India.

Dynamic Ordinary Least Square Method (DOLS) is used to estimate and predict the impact of education on economic development variables for Odisha. It is used to estimate the parameters of models that involve cointegrated variables and avoid spurious regression results.

Education and Economic Growth in India

Augmented Dickey Fuller Test is used to test the presence of unit root- cause for non-stationarity. The test showed the variables are non-stationary at level form [Table A1].

Johansen Cointegration indicates that there is a long run relationship. There is one cointegrating relation at 5 percent level of significance [Table A2] Philips Perron test also provides similar result.

The standard guideline is that when the p value is less than 5 percent we reject the null hypothesis. Therefore here all the three null hypothesis – None (p=0.02 percent), At most 1 (p= 0.25 percent) and At most 2 (p=0.45 percent) are rejected because their corresponding p values are less than 5 percent. The same result is also mentioned in the end of the table "Trace test indicates 3 cointegrating eqn(s) at the 0.05 level". This means that these three variables have long run association ship.

Here too the golden rule is followed that is when the p value is more than 5 percent we accept the null hypothesis [Table A3]. As such here using Maximum Eigenvalue all the three null hypothesis is rejected. Max-eigen value test indicates three cointegrating eqn(s) at the 0.05 level. Thus in the long run the variables move together. So we conclude from Johansen Cointegration test using the Trace Statistic and Max-Eigen Statistic that all three variables are cointegrated.

In order to verify short run relationship or short run adjustment of disequilibrium error we have employed Vector Error Correction model. The vector error correction model shows that there is no short run relation [Table A4].

The study wants to check the relation from public spending on education to economic growth, thus the GDP column is selected as the dependent variable. Though the error correct term is significant, the coefficient is positive. Hence the equilibrium error is not adjusted in short run.

As seen in the table the probability of public expenditure (0.0000) and population (0.4080) is less than 5 percent, so we can conclude that both are significant independent variable to explain the dependent variable GDP [Table A5].

R^2 represents coefficient of determination. An R^2 of 1 indicates that the regression line perfectly fits the data. Since R^2 is 99 percent, it means that the model is very nicely fitted here [Table A6].

Adjusted R-square compares the explanatory power of regression models that contain different numbers of predictors. It helps in preventing the addition of excess variables in the regression equation. With each extra variable included (which do not influence the dependent variable by a significant amount) the adjusted R-square falls. So 99 percent of adjusted R square means a better model.

In a regression line, smaller the standard error of the estimate is, the more accurate the predictions are. In the present model the value is relatively low (0.043574), so it can be believed that the equation is precise.

The Residual Sum of Squares (RSS), also known as the Sum of Squared Residuals (SSR) or the Sum of Squared Errors of prediction (SSE), is the sum of the squares of residuals (deviations predicted from actual empirical values of data). A small RSS (0.030380) indicates a tight fit of the model to the data.

The probability of F-statistic is less than 5 percent shows that the F-statistic is significant. It means that public spending on education and population jointly can influence our dependent variable GDP. It's a good sign for the model.

Education and Economic Growth in Odisha

Public expenditure on education, GSDP and population of Odisha data has been transformed to its natural log, the coefficient can be used as percentage change. The data when observed had shown the existence of a trend. So while performing the Augmented Dickey Fuller test for unit root test (stationarity test), trend and intercept has been included in the equation [Table A7].
All above three variables are stationary at first difference. Being the order of integration same we may move for verifying cointegrating relations.

The cointegration test indicated the presence of one cointegrating equation, since the p value (0.0000) is less than 5 percent so we reject the null hypothesis [Table A8]. The same result is also mentioned in the end of the table "Trace test indicates 1 cointegrating eqn(s) at the 0.05 level". This means that these three variables have long run association.

So we conclude from Johansen Cointegration test using the Trace Statistic and Max-Eigen Statistic that all three variables are cointegrated. So there is long run equilibrium relationship between GSDP, Population and Public Education Expenditure

In order to verify short run relationship or short run adjustment of disequilibrium error we have employed Vector Error Correction model [Table A9]. The vector error correction model shows that there is no short run relation.

As error correction term is not significant. Hence in short run there is no adjustment of equilibrium error. On using Fully Modified Least Squares (FMOLS), the data showed the presence of autocorrelation as the Durbin Watson statistic turned out to be (0.531724). Thus Dynamic OLS (Table A10) is used.

As seen in the table, the probability of public expenditure (0.0142) and population (0.0000) is less than 5 percent [Table A11]. We can conclude that both are significant independent variable to explain the dependent variable GSDP. Long run coefficient of expenditure and population significantly and positively influences GSDP.

Result and Discussion

To summarize in a single line, even though both central and state governments, with increase in population, increased their public spending on education, but unfortunately the econometric results showed that both at country level and at state (Odisha) level economic growth and education have long run relation (Johansen Cointegration Test) but not short run relationship (VECM).

Similar research, at different time period, conducted in India, using different variables, econometric tools also corroborate with our findings. For example Haldar and Mallik (2010) found that "human capital investment has significant long-run effect on per capita GNP...... investment in education human capital positively and significantly only for a short period of time". They derived their result using data from 1960 to 2001. Self and Grabowski (2004) used enrollment ratio and human capital stock data from 1966 to 1996 and pointed out that all education does not have positive relation with growth. Pradhan (1999) used cointegration and error correction model to study role of education on the export-led growth in India during 1951–2009 and concluded that "it does not find any significant" relation between education and export led growth.

Countries with huge population base have the advantage of cheap labour and thus prefer labour intensive method of production. The presence of only long run relation or lack of short run association ship between economic growth and education is unlikely mostly prevalent in these countries with huge population.

Out of the top 10 most populated nations, 8 countries have similar result as that of India, with an exception of USA (Baldwin & Borrelli, 2008), and Brazil (Lau, et. al, 1993).

China the most populated country has lowest return to education (Li and his friends, 2005 and 2008).

In Indonesia "pushdown effect on the occupational distribution of the better-educated" is observed (Jones, 1989).

In Nigeria too study found only long run relationship (Babatunde & Adefabi, 2005).

"Russia has both much human capital and an education system that produces the wrong skills for a market economy" (Fleisher, Sabirianova & Wang, 2005).

In Mexico "the accumulation of human capital, as proxied by education attainment, does not appear to be among the factors responsible for Mexico's disappointing growth performance since the early 1980s" (Psacharopoulos & Patrinos, 2004).

India's bordering populated nations like Pakistan (Abbas and Mukhtar, 2000), Bangladesh (Alam, Khalifa & Shahjamal, 2009), too face same situation.

Human resources have double dividend: Quantitative (number of people, productive labourer, and labour hours) and Qualitative (ability, understanding, and attributes needed for productive work). Education has the capacity to serve as complements for some resources and substitutes for others. It is observed that in countries like USA, that are technologically advanced, the returns to education is quite high because they focus on qualitative (complementary) aspect of human capital. Another example is Japan. Cheng and Hsu in 1997, conducted a research in Japan, where "the results basically confirm the hypothesis that an increase in human capital stock exerts positive effects on economic growth and vice versa". Capital abundant and technologically advanced nations tend to have positive short run impact of education on growth.

Within India a similar pattern is observed. Return to education is dependent on the way human capital is put to use. Dutta in 2006 wrote that "casual workers face at best flat returns to education". Return to education is more in urban areas than in rural India (Duraisamy, 2002). Even though Odisha has a annual growth rate of 10.30 in 2017-18, which is higher than national average, yet the lack of short run relationship between education and economic growth might be attributed to using its human capital as labourers (using only quantitative aspect or as substitute). Another reason of high economic growth of Odisha (with lack of short run contribution of education) is due to its high natural endowment.

Policy Suggestion

Education has the potentiality to influence the income level, in the long run, even though by a small amount. To quote John Maynard Keynes "In the long run we are all dead". Lack of contribution of education to economic growth in the short run, for a particular generation, may fail to motivate the next generation, to go for higher education. Thus, a high and positive short run association is the need of the hour. The current scenario demands more spending on job oriented education to increase earning capacity of Indian graduates. Study has shown that economically developed states have high concentration of incubators (Mitra & Panda, 2016; Mitra & Panda, 2017). The concept of University-Technology-Business-Incubators may be new in India and more so in Odisha, but successful implementation of UTBI by various reputed educational institutions in India and abroad is an example of collaboration between private and public sector. Similar steps in general education institutions can help both the country and students to achieve productive growth.

Based on National Skill Qualification Framework (NSQF) guidelines, new courses are soon to be introduced. Curriculum framing board should consist of people from five sections – Professor Emirates, Current Teachers, Human Resource Recruitment Team from Industry, Alumni, and Current Student Representatives. Expansion and upgrading vocational education and training is the market demand. "Think globally, act locally" concept can prove to be handy here. Local curriculum framework should be adopted to provide job to the son of the soil instead of national syllabus. Courses like commercial art and paintings (adopted in Rajasthan, Maharashtra. Karnataka) can be followed based on local tradition (Mitra & Panda, 2016).

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Annexure

Table A1: Augmented Dickey Fuller Test Results for India

Null Hypothesis: Existence of a unit root Exogenous: Constant, Linear Trend Lag Length: 0 (Automatic - based on SIC, maxlag=4)		
Variables and their p values	At level	First Difference
Log GDP at 2011-12 Base(LGDPCONST)	0.2379	0.0010
Log Educational Expenditure at 2011-12 Base (LEXPDEF)	0.2909	0.0035
Log Population (LPOP)	0.5814	0.0306

Source: As estimated by author based on data from RBI database

Table A2: Johansen Cointegration Trace values for India

Series: LGDPCONST LEXPDEF LPOP Unrestricted Cointegration Rank Test (Trace) Lags interval (in first differences): 1 to 1				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.713495	47.24528	29.79707	0.0002
At most 1 *	0.555682	23.49531	15.49471	0.0025
At most 2 *	0.346480	8.082250	3.841466	0.0045
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: As estimated by author based on data from RBI database

Table A3: Maximum Eigenvalue Cointegration values for India

Series: LGDPCONST LEXPDEF LPOP Unrestricted Cointegration Rank Test (Maximum Eigenvalue) Lags interval (in first differences): 1 to 1				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.713495	23.74997	21.13162	0.0209
At most 1 *	0.555682	15.41306	14.26460	0.0328
At most 2 *	0.346480	8.082250	3.841466	0.0045
Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Source: As estimated by author based on data from RBI database

Table A4: Vector Error Correction Estimates for India

Standard errors in ( ) & t-statistics in [ ]			
Cointegrating Eq:	CointEq1		
LGDPCONST(-1)	1.000000		
LEXPDEF(-1)	-1.983556		
	(0.26548)		
	[-7.47152]		
LPOP(-1)	6.551306		
	(1.97918)		
	[3.31012]		
C	-17.90603		
Error Correction:	*D(LGDPCONST)*	D(LEXPDEF)	D(LPOP)
CointEq1	*0.850097*	0.959312	0.003798
	(0.17643)	(0.27338)	(0.00407)
	[4.81841]	[3.50907]	[0.93230]
D(LGDPCONST(-1))	*-1.819561*	-2.079246	-0.005825
	(0.50902)	(0.78875)	(0.01175)
	[-3.57465]	[-2.63614]	[-0.49570]
D(LGDPCONST(-2))	*-1.175343*	-1.386234	-0.018884
	(0.53535)	(0.82956)	(0.01236)
	[-2.19545]	[-1.67106]	[-1.52781]

D(LEXPDEF(-1))	*1.669128*	1.981904	0.002671
	(0.44153)	(0.68417)	(0.01019)
	[3.78033]	[2.89681]	[0.26197]
D(LEXPDEF(-2))	*1.201150*	1.377527	0.019013
	(0.50984)	(0.79001)	(0.01177)
	[2.35595]	[1.74367]	[1.61529]
D(LPOP(-1))	*5.161425*	10.13992	0.545795
	(11.1799)	(17.3237)	(0.25812)
	[0.46167]	[0.58532]	[2.11454]
D(LPOP(-2))	*-4.497124*	-10.20066	0.277712
	(11.1013)	(17.2020)	(0.25630)
	[-0.40510]	[-0.59299]	[1.08353]
C	*0.064017*	0.073394	0.002385
	(0.11714)	(0.18151)	(0.00270)
	[0.54651]	[0.40434]	[0.88173]

Source: As estimated by author based on data from RBI database

Table A5: Fully Modified Least Squares (FMOLS)

Dependent Variable: LGDPCONST
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXPDEF	0.821503	0.132767	6.187569	0.0000
LPOP	0.753018	0.887510	0.848462	0.4080
C	-2.477203	2.650514	-0.934612	0.3631

Source: As estimated by author based on data from RBI database

Table A6: Statistical values for India

R-squared	0.995018
Adjusted R-squared	0.994083
S.E. of regression	0.043574
Sum squared residual	0.030380
F-statistic	1065.086
Prob(F-statistic)	0.000000

Source: As estimated by author based on data from RBI database

Table A7: Augmented Dickey Fuller Test Results for Odisha

Null Hypothesis: Existence of a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

Variables and their p values	First Difference
Log GSDP at 2011-12 Base(LGSDPCONST)	0.0146
Log Educational Expenditure at 2011-12 Base(LEXPDEF)	0.0259
Log Population (LPOP)	0.0267

Source: As estimated by author based on data from RBI database

Table A8: Cointegration Rank Test (Trace) for Odisha

Series: LGDPCONST LEXPDEF LPOP
Unrestricted Cointegration Rank Test (Trace)
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.972998	75.41604	42.91525	0.0000
At most 1	0.573312	21.23812	25.87211	0.1696
At most 2	0.431170	8.462599	12.51798	0.2162

Trace test indicates 1 cointegratin geqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: As estimated by author based on data from RBI database

Table A9: Maximum Eigenvalue values for Odisha

Series: LGDPCONST LEXPDEF LPOP
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.972998	54.17792	25.82321	0.0000
At most 1	0.573312	12.77552	19.38704	0.3465
At most 2	0.431170	8.462599	12.51798	0.2162

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: As estimated by author based on data from RBI database

Table A10: Vector Error Correction Estimates for Odisha

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LGSDPCONST (-1)	1.000000
LEXPDEF (-1)	-2.872256
	(1.44523)

	[-1.98741]		
LPOP (-1)	10.40758		
	(11.9461)		
	[0.87121]		
C	-172.9171		
Error Correction:	D(LGSDPCONST)	D(LEXPDEF)	D(LPOP)
CointEq1	*-0.009660*	0.069865	0.000506
	(0.00714)	(0.07422)	(0.00027)
	[-1.35235]	[0.94134]	[1.87159]
D(LGSDPCONST (-1))	*0.175858*	1.064317	0.021690
	(0.26692)	(2.77329)	(0.01011)
	[0.65884]	[0.38377]	[2.14520]
D(LEXPDEF (-1))	*-0.046424*	-0.091628	-0.005565
	(0.03143)	(0.32651)	(0.00119)
	[-1.47730]	[-0.28063]	[-4.67512]
D(LPOP (-1))	*4.150243*	-21.78387	-0.180518
	(4.74001)	(49.2487)	(0.17955)
	[0.87558]	[-0.44232]	[-1.00539]
C	*0.054105*	0.126665	0.013047
	(0.06432)	(0.66825)	(0.00244)
	[0.84122]	[0.18955]	[5.35541]

Source: As estimated by author based on data from RBI database

Table A11: Dynamic Least Squares (DOLS) for Odisha

Dependent Variable: LGDPCONST
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXPDEF	0.230020	0.062383	3.687226	0.0142
LPOP	11.84200	0.825482	14.34556	0.0000
C	-196.9506	14.24611	-13.82487	0.0000

Source: As estimated by author based on data from RBI database