Efficiency and Productivity Analysis of Elementary Education in India

SYNOPSIS

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Synopsis

Elementary Education sector plays crucial role in determining the well-being of the entire society and the progress of the whole country. Therefore, it needs special attention. Given the vast development of elementary education in India it will be interesting to focus on the district level performance in terms of technical efficiency and total factor productivity growth. The basic question for the elementary education sector is whether the sector is producing maximum output given the use of inputs or, alternatively, whether it is using optimum amount of inputs to produce the given level of output. At the same time what is the extent of total factor productivity growth, measuring the extent of output growth not accounted by the growth of inputs, is an important question. The reason behind the attention for district level study of major selected states is that, one needs to identify the states/districts which are bad performers so that appropriate policies can be framed to improve the bad performing states/districts and hence to reduce the disparities among districts as well as states. Thus, it is utmost important to have a clear idea regarding backward regions and their relative position with respect to good performing regions. The study gives a detailed analysis of the performance of the sector and to prescribe appropriate policies to enhance the level of performance.

The perusal of the literature reveals that there are the gaps in the existing literature relating to the measurement and finding out significant determinants of technical efficiency and productivity of elementary education at the district level for India. ***The present study tries to overcome these limitations and further contributes to the literature in the following sense***. ***First of all***, the study evaluates measurement and determinants of technical efficiency and productivity performance separately for primary and upper primary levels of education for nine consecutive years from 2005-06 to 2013-14 for 461 districts (as per DISE) of 16 major selected states in India namely, Andhra Pradesh (AP), Assam (AS), Bihar (BI), Gujarat (GJ), Haryana (HA), Himachal Pradesh (HP), Karnataka (KA), Kerala (KE), Madhya Pradesh (MP), Maharashtra (MH), Orissa (OR), Punjab (PN), Rajasthan (RA), Tamil Nadu (TN), Uttar Pradesh (UP) and West Bengal (WB). The relevant data used in the analysis is collected from different issues of District Reports Cards (DISE). The earlier studies in Indian context did not consider such district level over time analyses. This serves the objective for comparison of the primary and upper primary levels of education, studies for which are not well captured in the literature. Technical efficiency can be visualised in two alternative ways: whether the sector is generating maximum output given the input usage (the basis of the concept of output oriented technical efficiency), or given the output level the sector is using minimum amount of inputs as determined by the technology constraint (the basis of the concept of

input oriented technical efficiency). This present study considers the output oriented technical efficiency (TEOUT) measuring to what extent the sector is below the maximum possible output and to what extent output can be expanded, given the levels of input usages. The input oriented technical efficiency (TEINP) depicting the extra usage of inputs to produce a given level of output i.e. the extent to which the input usage can be contracted, given the output level produced is also measured. Regarding productivity, one can use either partial productivity or total factor productivity growth (TFPG) which shows the growth in output which is not accounted by the growth in inputs and basically encompasses the concept of technical efficiency change, technical change and scale efficiency change. The present study uses the concept of total factor productivity growth (TFPG). There is a dearth of such type of study at the district level and separately for primary and upper primary levels of education over consecutive time frame. In tune with the literature, measurement of technical efficiency and total factor productivity growth requires assumption of production function, which necessitates identification of inputs and outputs. Relevantly, it will be useful to highlight the following difference between this educational production function and the standard production function used in micro theory: (a) the output produced in case of education is not the tangible output. Thus one needs to represent the output using some suitable measures. For example, present study considers two outputs for the measurement of efficiency score: (i) net enrolment ratio (NER) and (ii) percentage of students passed having greater than 60% in the examination. The second output measures the attainment of quality. There can be other measures of output as well. Similarly, following input variables are considered : (i) number of schools per lakh population, (ii) teacher-pupil ratio in the school, (iii) classroom-student ratio in the school and (iv) percentage of teachers with qualification graduate and above in the school, measuring the quality of the teacher input. (b) both the output and the inputs in the production process do not have prices. Thus, one needs to obtain their shadow prices for further analysis. Therefore, the ***second*** point of the contribution of the present thesis to the literature is that in the estimation procedure for efficiency and productivity it considers both quantities as well as quality aspects of the outputs and inputs and there is scarcity of such approaches in the existing studies. ***Thirdly,*** the present analysis also measures whether there is more usage of different inputs over the optimum or not at district level, for both primary and upper primary levels of education and tried to identify the input for which there is maximum extra usage; studies for which are lacking in the literature. ***Fourthly,*** decomposition of TFPG into its respective components for primary and upper primary levels separately is also an interesting aspect of the thesis. TFPG can be decomposed into technical efficiency change (TEC), technical change (TC) and scale efficiency change (SEC). If the movement of TFPG is attributed by the scale change, it may not be sustained in the long run because of assumption of diminishing returns to scale. On the other hand, if the change in TFPG is mainly

guided by either technical change or technical efficiency change, it will be more beneficial for sustained growth. There is lack of such studies at the district level separately for primary and upper primary levels of education. ***Finally,*** while explaining the significant factors of technical efficiency and total factor productivity growth some poor and favourable infrastructural, social and policy indicators are taken into account. Instead of using composite index, the study captures the individual effect of the different explanatory variables. This is because for identification of appropriate policies, the individual effect of the variable that matters. The study also prescribes appropriate policies to enhance the level of performance of output oriented technical efficiency, input oriented technical efficiency and total factor productivity growth for both primary and upper primary levels of education and also identifies the common factors that can enhance the level of these three performance indicators jointly.

The present analysis helps us to find out the answer of the above research questions. To proceed further analysis, after obtaining the district wise measures in terms of the three performance indicators TEOUT, TEINP and TFPG for nine consecutive years, mean value of each of these three performance indicators is calculated for each of the districts. From these estimated district level mean values, state specific average (SSA) and state specific CV are obtained for each of these three performance indicators. Ultimately a grand mean consisting of the mean of state specific average (SSA) and the coefficient of variation of each of these performance indicators is computed for both primary and upper primary levels of education. The obtained figures are used to carry out interstate comparison of the three indicators namely TEOUT, TEINP and TFPG and also to make the comparison between primary and upper primary levels of education.

Coming into the topic ***TEOUT,*** the empirical results reveal that not all the districts are perfectly technically efficient either at the primary or upper primary levels of education in the sense to produce the maximum level of output given the input used in the production process. Out of the 461 districts (as per DISE) only 15.62% (primary) and 7.22% (upper primary) are fully technically efficient throughout the study period implying that they are on the frontier.

In case of ***primary level,*** the grand mean consisting of the mean of state specific average (SSA) is 0.956 and on an average percentage of the districts higher than SSA is 61.66. The estimated value of mean TEOUT for different years under the sample period suggests a marginal increase. The following states have higher than grand mean- AP, AS, BH, GJ, HP, KA, KE, MP and TN. The highest SSA TEOUT occurs for the state AS (0.982) followed by KE (0.980) and lowest for PN (0.901). The grand mean value of the state specific coefficient of variation (CV) of the measure TEOUT is 4.79%. The states which have CV below the grand mean of CV are the following: AP (3.31%), AS (2.66%), BH (2.63%), GJ (4.69%), HP (3.80%), KA (4.06%), KE (1.69%), MH (4.41%) and TN (2.73%).

Thus, except MP, all the states having higher state specific average TEOUT as compared to the grand mean, also possess lower value of state specific CV as compared to the grand mean of CV, implying that their performance is good both in terms of level and variability of output oriented technical efficiency. All over performance assessed by the coefficient of variation (CV) reveals that the state KE (1.69%) and PN (11.99%) are in the first and last position respectively. Performance of PN is poor because not only it possesses lowest state specific average TEOUT, but also highest level of state specific CV.

Considering the ***upper primary level of education,*** the grand mean consisting of the state specific average for all the states is 0.918 and on an average percentage of the districts higher than state specific average is 55.75. The estimated value of mean TEOUT for different years under the sample period suggests that there is an increase in technical efficiency score. The states having higher than the grand mean score are- AP, AS, GJ, HP, KA, KE, MH, PN, RA and TN. The states HP (0.981) and KE (0.973) have high SSA compared to other states, whereas UP (0.784) has the lowest level of SSA. The grand mean value of the state specific coefficient of variation (CV) of the TEOUT measure is 5.24%. The state specific CV is lowest for BH (0.64%) and is highest for WB (13.36%). The states which have CV below the grand mean of CV are the following: AS (4.16%), BH (0.64%), GJ (3.62%), HP (2.94%), KA (3.76%), KE (2.99%), MH (4.50%), PN (4.15%), TN (4.41%) and UP (4.29%). ***Thus, except AP and RA, all the states having higher state specific average TEOUT as compared to the grand mean of TEOUT, also possess lower value of state specific CV as compared to the grand mean of CV, implying that their performance is good both in terms of level and variability of output oriented technical efficiency measure.***

Comparison of the results of primary and upper primary levels of education with respect to output oriented technical efficiency measure reveals that (i) grand mean of TEOUT is higher for the primary as compared to upper primary, (ii) the percentage of the districts which is perfectly efficient is less for upper primary (7.22%) as compared to primary (15.62%) and (iii) the performance of some of the states namely AS, GJ, HP, KA, KE and TN is good in case of both primary and upper primary levels of education as these states belong to the group having higher state specific average (SSA) of TEOUT than grand mean of TEOUT and lower state specific value of CV as compared to the grand mean CV of TEOUT.

After looking into the significant determinants of output oriented technical efficiency of primary and upper primary levels of education, it is evident that the ***following common factors have significant impact in explaining the variation of output oriented technical efficiency score for both the levels of education.*** For example, output oriented technical efficiency score of both the levels of education are ***(a) negatively and significantly influenced by the variables from the poor infrastructure like*** percentage of schools without building, percentage of

classrooms in 'bad' condition , percentage of single teacher schools, percentage of single classroom schools and percentage of schools with no blackboard, (b) ***positively and significantly influenced by (i) the variables from the favourable infrastructure like*** percentage of schools with common toilet facility and percentage of schools with girls' toilet facility, ***(ii) the social indicators like*** percentage of SC enrolment, percentage of ST enrolment, percentage of girls enrolment to boys and percentage of schools with girls' toilet to common toilet, ***(iii) the policy variables,*** namely percentage of girls getting free text books to boys, percentage of girls getting free stationery to boys and percentage of schools received teaching learning material (TLM) grant.

Further, apart from the factors as mentioned above, it is possible to identify some factors which solely affect the output oriented technical efficiency of primary and upper primary levels of education respectively. For example, additionally, the factors from the favourable infrastructure like percentage of schools with drinking water facility and the factors from policy variable like percentage of students getting free text books and percentage of students getting free stationery only affect the TEOUT of primary level of education positively. Similarly, percentage of schools having no pucca building, percentage of students getting free uniforms and percentage of schools received school development (SD) grant only affect the output oriented efficiency score of upper primary level of education significantly.

Thus, the relationship between the output oriented technical efficiency and different explanatory variables reveals that efficiency score for both the primary and upper primary levels of education is positively related to favourable infrastructure, social and policy indicators and negatively related to the poor infrastructural variables of the school at district level. The positive relationship indicates that improvement in the favourable, social and policy variables will lead to the higher level of efficiency.

Considering the concept ***TEINP,*** in case of primary level of education grand mean of SSA corresponds to 0.914. The estimated value of mean TEINP for different years under the sample period suggests a marginal decrease. The average value of the percentage of the districts higher than SSA is 53.43. On an average relatively small percentage (12.56%) of the districts is perfectly technically efficient throughout the period. The states having SSA higher than grand mean are the following- AP, AS, HP, KE, OR, PN, RA and WB. The SSA is highest for HP (0.974) followed by AP (0.953), KE (0.953) and WB (0.953) and lowest for MH (0.782). The states having lower state specific coefficient of variation (CV) for the indicator TEINP as compared to the grand mean of CV are the following: AP (4.77%), HA (7.09%), HP (5.30%), KE (6.22%), OR (5.21%), RA (5.75%), TN (6.22%) and WB (5.44%). ***Thus, regarding TEINP for primary level of education, the performance of the states namely AP, HP, KE, OR, RA and WB is good as these states have higher state specific average TEINP as compared to***

the grand mean and also possess lower value of state specific CV as compared to grand mean of CV, implying higher mean level and lower variability of TEINP.

Considering the upper primary level of education it can be observed that grand mean level of SSA of TEINP turned out to be 0.931 implying that not all the districts as well as respective states are fully technically efficient. The estimated value of mean TEINP reveals that there is marginal increment of efficiency score over the study period. In case of SSA of TEINP the following states have higher than the grand mean –AP, AS, BH, GJ, HP, KA, KE, PN and RA. Grand mean of percentage of the districts higher than SSA is 55.795. The average value of the percentage of the districts having TEINP equal to 1 is 8.87. Thus the majority of the districts have their SSA of TEINP greater than the grand mean level. The SSA for input oriented efficiency related to upper primary level of education is highest for the state KE (0.978) and lowest for UP (0.834). The grand mean of CV obtained from the state specific CV of TEINP for the upper primary level of education is 5.802%. The state specific CV is highest for PN (11.13%) and is lowest for KE (3.00%). The states for which the state specific CV is below the grand mean of CV are the following: AP, AS, BH, HA, HP, KA, KE, OR and TN. ***The comparison of the state specific average of TEINP and state specific CV of TEINP reveals that the performance of the states namely AP, AS, BH, HP, KA and KE is good as they possess higher mean and lower variability as compared to the grand value of mean and CV of TEINP.***

District wise as well as respective state wise distribution of the percentage of the ratios of radial and slack movements to that of average of actual movements of the four inputs from 2005-06 to 2013-14 is obtained for both primary and upper primary levels of education. According to the findings, the presence of input slack and radial movements basically implies that all the districts are not fully technically efficient in the sense that inputs or resources are not used optimally.

For ***primary level of education,*** radial movement follows similar pattern for all the inputs. It was found that considering all the four inputs the lowest SSA value of ***radial movement*** occurs for HP and highest value occurs for MH. For the input ***number of schools per lakh population*** lowest SSA of ***slack movement*** occurs for KE (1.15%) and highest value is observed for TN (10.70%). In case of the input ***teacher-pupil ratio*** lowest SSA of slack movement is attained at GJ (1.60%) and KE (2.22%) and highest value occurs for the state MH (8.89%). Considering ***classroom-student ratio*** least and highest value occurs in the state OR (1.88%) and MH (8.92%) respectively. For the input ***percentage of teachers with qualification graduate and above,*** SSA of slack movement is lowest for HP (0.07%) and is highest in the state HA (3.25%). In case of ***primary level of education*** comparing the grand mean of ***combined radial and slack movements*** of different inputs used in the production process it is evident that the grand mean

is highest for ***classroom-student ratio (13.42%)*** followed by ***teacher-pupil ratio (12.79%), number of schools per lakh population (12.27%)*** and lowest for ***percentage of teachers with qualification graduate and above (9.62%),*** showing that degree of nonoptimal use is highest for the input classroom-student ratio. Coming into the ***combined radial and slack movements,*** it can be observed that for the four different inputs the pattern is same corresponding to primary level of education. The state specific average of combined movement is lowest for HP and highest for MH.

On the other hand, corresponding to ***upper primary level of education,*** the grand mean level of ***combined radial and slack movements*** is largest for the input like ***number of schools per lakh population (13.31%)*** followed by ***classroom-student ratio (12.24%), teacher-pupil ratio (10.74%)*** and lowest for the input, namely ***percentage of the teachers with qualification graduate and above (8.56%).*** As in the case of primary level, in upper primary level also radial movement follows similar pattern for all the inputs. It was found that in case of ***radial movement*** the lower value of SSA for all four inputs used occurs for KE and PN whereas the highest level is obtained from the state UP. While discussing about the ***slack movement,*** SSA is least for HP (2.74%) and highest for TN (13.98%) for the input like ***number of schools per lakh population.*** In case of ***teacher-pupil ratio*** lower value is occurred for the state KA (0.40%) and KE (0.79%) but highest value is observed for UP (10.67%). For the input ***classroom-student ratio*** least and highest level of SSA are observed in the state UP (4.18%) and TN (17.75%) respectively. In case of the remaining input ***percentage of teachers with qualification graduate and above*** the SSA is lowest in the state, namely HP (0.00) and highest level of SSA occurs for MH (4.75%).

Considering upper primary level, SSA of ***combined radial and slack movements*** for the inputs ***number of schools per lakh population*** and ***teacher-pupil ratio*** is lowest for the state HP (5.07%) and KE (2.97%) respectively. The highest value is observed for TN (27.13%) and UP (24.39%) respectively. Similarly, in the case of ***classroom-student ratio*** (6.72%) and ***percentage of teachers with qualification graduate and above*** (2.33%) the SSA of combined movement is lowest for the state HP. For these two inputs highest SSA of combined movement occurs for the state MP (20.21%) and UP (16.71%) respectively.

Therefore the analysis regarding the input utilization suggests that among the four inputs employed in the production process the inputs like classroom-student ratio and number of schools per lakh population, have high level of inefficiency in usage at the primary and upper primary levels of education respectively whereas the level of inefficiency is least for the percentage of teachers with qualification graduate and above at both the levels of education. The results support the fact that the same level of usage of these inputs can produce more of output in each of

the level of education or alternatively, same level of output can be produced by the smaller amount of inputs.

The comparison of TEINP at primary and upper primary levels of education reveals that (i) the states such as AP, AS, HP, KE, PN and RA have higher SSA as compared to grand mean for both primary as well as upper primary and (ii) the states AP, HA, HP, KE, OR and TN have lower CV of TEINP as compared to grand mean of CV for both primary and upper primary levels of education. Thus performance of the states AP, HP and KE are good for both primary as well as upper primary, as they have SSA of TEINP higher than grand mean TEINP and less CV of TEINP as compared to grand mean of CV or, less variability, (iii) percentage of districts with SSA higher than grand mean is greater for upper primary (55.795%) as compared to primary level (53.43%), (iv) the percentage of districts lying on the frontier is less for upper primary (8.87%) as compared to primary level (12.56%) and (v) the combined radial and slack movements of different inputs namely teacher-pupil ratio, classroom-student ratio and the percentage of teachers with qualification graduate and above is less for upper primary level, except for the input number of schools per lakh population.

A closer look at the results reveal that there are ***some common factors which significantly influence input oriented efficiency score for both the primary and upper primary levels.*** TEINP is ***(a) negatively and significantly*** influenced by the existence of ***poor infrastructure*** like (i) percentage of schools without building, (ii) percentage of schools with no pucca building, (iii) percentage of classrooms in 'bad' condition, (iv) percentage of single teacher schools, (v) percentage of single classroom schools and (vi) percentage of schools with no blackboard and **(b) *positively*** influenced by ***different favourable infrastructure*** namely, (i) percentage of schools with drinking water facility, (ii) percentage of schools with common toilet facility and (iii) percentage of schools having girls' toilet facility and (c) also by different ***policy variables*** like (i) percentage of students getting free text books, (ii) percentage of students getting free uniforms, (iii) percentage of students getting free stationery and (v) percentage of schools received teaching learning material (TLM) grant.

Apart from the above mentioned determinants the factors which are additionally responsible for variation in input oriented technical efficiency score at primary level of education are percentage of girls getting free text books to boys and percentage of girls getting free stationery to boys. Similarly in case of upper primary level, percentage of schools received school development (SD) grant is a significant variable in enhancing the level of TEINP.

Considering the estimated relationship, it is observed that input oriented technical efficiency is negatively related to the poor infrastructural facilities whereas

positively related to the favourable and policy indicators at both primary and upper primary levels of education.

Coming into the topic ***TFPG,*** the district wise analysis of TFPG reveals that there is wide variation of the magnitude of MPI, for both primary and upper primary levels of education. The grand mean of productivity index for all the districts and all the years under study taken together turned out to be 1.21 and 1.15 for primary and upper primary levels of education respectively.

In case of ***primary level,*** the states having SSA higher than grand mean are the following– AP, AS, BH, GJ, HP, KA, KE, MH, OR, RA, TN and UP. The highest state specific average TFPG occurs for the state GJ (1.269) and the lowest value occurs for HA (1.096). The grand mean of CV obtained from the state specific CV of TFPG for primary level of education turned out to be 7.326%. The highest value of state specific coefficient of variation (CV) occurs for the state WB (9.05%), while its lowest value is assigned to HP (5.96%). The states having CV lower than the grand mean are the following: AP (5.99%), BH (6.53%), HP (5.96%), KE (6.21%), OR (7.31%), TN (6.40%) and UP (6.92%). ***Thus for primary level of education, performance of the states AP, BH, HP, KE, OR, TN and UP is good with respect to TFPG as these states belong to the group of states having (i) higher state specific average value as compared to the grand mean of TFPG and (ii) lower value of state specific CV as compared to the grand mean of CV.***

Considering ***upper primary level*** of education the states AP, AS, GJ, HP, MP, PN, TN and UP have higher SSA value as compared to the grand mean. The highest value of state specific average of TFPG occurs for the state AP (1.138), while it is lowest for HA (1.049). The grand mean of CV of all the state specific CV of TFPG turned out to be 8.394%. The highest value of state specific CV turned out to be 11.25% for the state AP, while it is lowest for the state BH (5.87%). The states having CV lower than grand mean CV are the following: AS (6.71%), BH (5.87%), GJ (7.54%), KE (7.55%), PN (8.13%), RA (5.95%), TN (7.83%) and WB (7.97%). Thus the performance of the states AS, GJ, PN and TN is good as they have higher state specific average TFPG value as compared to the grand mean and also lower state specific CV of TFPG.

The comparison of primary and upper primary levels of education reveals that (i) for both the levels of education the states such as AP, AS, GJ, HP, TN and UP have high SSA as compared to the grand mean of TFPG, (ii) the states namely BH, KE and TN have lower CV as compared to grand mean of CV for both levels and (iii) the percentage of districts with SSA higher than grand mean is higher for primary (58.83%) than upper primary (53.87%).

Coming to the ***productivity growth rate***, for ***primary level of education*** KE exhibits highest productivity growth rate (PGR). The grand mean of PGR for all the states turned out to be 6.304%. The states higher than grand mean of PGR are the following: GJ, HA, KA, KE, MH, PN and RA.

For ***upper primary level,*** the grand mean of PGR for all the states taken together is 20.829%. The highest PGR is achieved by the state KE over the study period. The states having PGR greater than the grand mean are the following: AS, KA, KE, MP, MH, PN and RA.

Coming into the ***decomposition analysis*** the empirical result suggests that all the three components of MPI namely technical efficiency change (TEC), technical change (TC) and scale efficiency change (SEC) have importance in determining the trend of MPI at district as well as respective state level for both primary and upper primary levels of education. In both the cases the contribution of technical change (grand mean value of primary state specific average (SSA) is 1.213 and upper primary state specific average is 1.418) are higher followed by technical efficiency change and scale efficiency change. The results of decomposition of the productivity index reveal that on average the productivity changes are mainly occurred due to technical change, mostly over the sample period from 2005-06 to 2013-14 for both primary and upper primary levels of education. The result is true for absolute level as well as the rate of change. Relevantly, it may be mentioned that if the growth factor is attributed by the scale change, it may not be sustained in the long run because of assumption of diminishing returns to scale. But if the change in productivity is mainly contributed by either technical change or technical efficiency change that will be more beneficial as it can be sustained in the long run.

The regression results suggest the significant common determinants for both primary and upper primary levels of education respectively. For example, TFPG of both the levels of education is (1) ***negatively and significantly related*** to the different ***poor infrastructural facilities*** such as (a) percentage of schools without building, (b) percentage of schools having no pucca building, (c) percentage of classrooms in 'bad' condition and (d) percentage of single-teacher schools, (2) is ***positively and significantly related*** to (i) ***favourable infrastructural facilities*** namely (a) percentage of schools with drinking water facility (b) percentage of schools with common toilet facility and (c) percentage of schools having girls' toilet facility and the (ii) ***social indicators*** like (a) percentage of girls enrolment to boys and (b) percentage of schools with girls' toilet to common toilet and (iii) ***different policy indicators*** namely (a) percentage of students getting free text books, (b) percentage of students getting uniforms, (c) percentage of students getting free stationery, (d) percentage of girls getting free stationery to boys, (e) percentage of schools received school development (SD) grant and (f) percentage

of schools received teaching learning material (TLM) grant are important factors responsible for variation in MPI over study period.

Apart from these factors, productivity index corresponding to primary level of education is (i) negatively and significantly affected by the factor from poor infrastructure such as percentage of schools with no blackboard and (ii) positively influenced by the policy variable like percentage of girls getting free text books to boys.

Thus, the estimated relation captures that TFPG is positively related to the different favourable infrastructure, social and policy indicators whereas productivity index is negatively influenced by poor infrastructural facilities.

An interstate comparison is performed in terms of output and input oriented technical efficiency and TFPG taken together for each of the 16 major selected states for primary and upper primary levels of education. From the empirical findings wide variation of output and input oriented TE and TFPG at district as well as respective state level is evident.

In case of primary level of education the states such as AP, AS, HP and KE are the good performers as they have above average (AA) output and input oriented technical efficiency as well as productivity score. However the performance of the state AS cannot be taken as good as it possesses high CV as compared to the grand CV in case of TEINP and TFPG. The states like BH, GJ, KA and TN exhibit AA output oriented technical efficiency and TFPG but below average (BA) input oriented efficiency. GJ and KA also have high CV as compared to the grand mean of CV for the indicator TEINP and TFPG. HA is a bad performer state as it has BA TEOUT, TEINP and TFPG simultaneously. The state KE is said to be a good performer in terms of both technical efficiency and productivity score and also contains less variability as suggested by CV figure. The states such as PN and WB have BA TEOUT and TFPG but AA TEINP. The CV for PN is high for the three indicators, whereas WB contains high CV for TEOUT and TFPG. MH and UP have BA TEOUT and TEINP but AA TFPG. MH contains high CV for TEINP and TFPG, whereas CV for UP is high for TEOUT and TEINP. For MP it can be found that there is AA TEOUT, BA TEINP and TFPG. Also MP contains high CV for TEOUT, TEINP and TFPG. In case of OR and RA though the states exhibit BA TEOUT but they have AA TEINP and TFPG. The state OR contains high CV only for TEOUT. RA contains high CV for TEOUT and TFPG.

In case of the upper primary level of education somewhat different picture can be observed compared to the primary level. The states like AP, AS, GJ, HP and PN have behaved similarly – they have AA output oriented, input oriented and TFPG. However, among these states, the performance of the state AP cannot be taken as

good as it possesses high CV as compared to grand mean of CV in case of TEOUT and TFPG. Similarly, GJ also have high CV with respect to TEINP. HP has high value of CV as compared to grand mean of state specific CV for the indicator TFPG. The state PN possesses high CV as compared to grand mean of CV in case of TEINP. Three states, namely HA, OR and WB have experienced BA TEOUT, TEINP and TFPG simultaneously. The states HA and OR contain high CV for TEOUT and TFPG, whereas the state WB has high CV for TEOUT and TEINP. For the states like KA, KE and RA it is found that there is AA TEOUT and TEINP but BA TFPG. The state KA contains high CV for TFPG, whereas for RA, CV is high for TEOUT and TEINP. The state KE exhibits marginally below TFPG and the CV for KE is low for all the three performance indicators. The 5 remaining states have performed differently. For the state BH there is BA TEOUT and TFPG but AA TEINP and the CV for BH is low for TEOUT, TEINP and TFPG. For MP and UP it is observed that there is BA TEOUT and TEINP but AA TFPG and the CV for MP is high for all the three performance indicators. The state UP has experienced high CV with respect to TEINP and TFPG. The state MH has AA TEOUT, BA TEINP and BA TEINP and the CV for MH is high for the performance indicators namely TEINP and TFPG. For TN it is observed that there is AA TEOUT and TFPG but BA TEINP and the CV for TN is low for all the three performance indicators.

For better clarification, we have classified the states into two groups having higher and lower value of state specific average as compared to the grand mean of the three performance indicators. For the three performance indicators namely TEOUT, TEINP and TFPG we have computed the group mean of state specific average and also the group CV, both for primary as well as upper primary levels of education. For primary level of education, it is found that the coefficient of variation of the first group of states (states having higher state specific average (SSA) with respect to grand mean) for the three performance indicators namely TEOUT, TEINP and TFPG is ***lower*** as compared to the coefficient of variation of the second group of states (states having lower SSA with respect to grand mean). ***Thus for the primary level of education the performance of first group of the states with respect to all the three chosen performance indicators namely TEOUT, TEINP and TFPG is on average better in terms of both mean value of the indicators and its variability.***

For upper primary level of education, it is found that the coefficient of variation of the first group of states (states having higher state specific average (SSA) with respect to grand mean) for the two performance indicators namely TEOUT and TEINP is ***lower*** as compared to the coefficient of variation of the second group of states (states having lower SSA with respect to grand mean). But for the performance indicator TFPG the value of the coefficient of variation of the first group of the states is higher than the coefficient of variation of the second group.

Thus, for the upper primary level, the performance of first group of the states is better in terms of both mean value of the indicators and its variability only for the two chosen performance indicators namely TEOUT and TEINP. For the other performance indicator TFPG, the performance of first group of the states is better only in terms of mean value of the indicator.

Since we are considering relative performance, the empirical results reveal that AA TEOUT does not imply AA TEINP or AA TFPG. For example AA TEOUT and TFPG but BA TEINP occurs for KA (primary) and TN (upper primary). Also AA TEOUT but BA TEINP and TFPG occur for MP (primary) and MH (upper primary). Similarly BA TEOUT can be associated with AA TEINP and TFPG which happens in the state OR corresponding to primary level. Also BA TEOUT along with AA TEINP and BA TFPG hold for the state WB (primary) and BH (upper primary).

From the empirical analysis, it is clearly evident that there are some common significant determinants in explaining the three different indicators, namely output oriented technical efficiency, input oriented technical efficiency and total factor productivity growth for primary and upper primary levels of education.

For example, it is evident that the three indicators namely TEOUT, TEINP and TFPG of primary as well as upper primary levels of education are (i) ***negatively influenced by the factors from poor infrastructure*** like percentage of schools without building, percentage of classrooms in 'bad' condition and percentage of single-teacher schools, (ii) ***positively influenced by the factors from favourable infrastructure*** like percentage of schools having common toilet facility and percentage of schools having girls' toilet facility, (iii) ***positively influenced by the policy variable*** like percentage of schools received TLM grant. Additional variable commonly influencing TEOUT, TEINP and TFPG for primary level are (i) percentage of schools with no blackboard from poor infrastructure, (ii) percentage of schools with drinking water facility from favourable infrastructure and (iii) percentage of students getting free text books, (iv) percentage of girls getting free text books to boys, (v) percentage of students getting free stationery, (vi) percentage of girls getting free stationery to boys from policy variables. Similarly, for upper primary level, TEOUT, TEINP and TFPG are simultaneously influenced (a) negatively by the variable from poor infrastructure like percentage of schools having no pucca building and (b) positively by the policy variables like (i) percentage of students getting school uniforms and (b) percentage of schools received school development (SD) grant.

Apart from these variables, ***social indicators*** like percentage of SC enrolment, percentage of ST enrolment, percentage of girls enrolment to boys and percentage of schools with girls' toilet to common toilet will positively affect output oriented technical efficiency of both primary and upper primary levels of education.

Similarly, the TFPG of primary as well as upper primary level of education will also be positively affected by the social indicators like percentage of girls enrolment to boys and percentage of schools with girls' toilet to common toilet.

Further, the present analysis could isolate the individual effect of the variables under each of these broader categories which could stimulate TEOUT, TEINP and TFPG of both primary and upper primary levels of education as well as the common factors influencing the level of these three indicators of both primary as well as upper primary and hence will be useful for selecting appropriate policies to increase the performance of these indicators for two levels of education.

Considering all three performance indicators ***following are the policy suggestions emerged from the whole analysis*** –

The present study highlights the role of the broad indicators like poor infrastructure, favourable infrastructure, social indicators and policy variables in explaining the performance of the indicators. Further, it isolates the individual component of each of the indicators which can accentuate output oriented technical efficiency, input oriented technical efficiency and total factor productivity growth of primary and upper primary levels of education and also the common factors influencing the three performance indicators jointly. The government policies for constructing school building, improving condition of the class room, increasing the number of the teachers in the school, providing black board to the schools, providing both girls' toilet and common toilet, providing free text books and stationery to the students and specially the girl students will likely to enhance output oriented technical efficiency, input oriented technical efficiency and total factor productivity growth for both primary and upper primary levels of education. Additionally, construction of pucca building of the school, providing school uniforms, school development (SD) grant will simultaneously influence TEOUT, TEINP and TFPG of upper primary level of education. Similarly, provision of drinking water facilities to the school and teaching learning material grant will promote TEOUT, TEINP and TFPG for primary level simultaneously. Further, the government policies of social inclusion i.e. increasing enrolment of SC, ST and girls and provision of girls' toilet will promote output oriented technical efficiency of both primary as well as upper primary levels of education. An increase in girls' enrolment and provision of girls' toilet will promote TFPG of primary and upper primary levels of education as well.

At the end it may be noted that the performance of teaching services will rest on the regularity of the teachers. A student's performance will rely upon some circumstances which will be identified by the socio economic condition of the household. Another issue is that, nowadays student takes private tuition that can affect efficiency and productivity of education system. Similarly, efficiency and productivity can be affected by the provision of mid-day meal. In order to get

these effects, one needs to have primary data and also information on such indicators like income of the household, educational qualification of parents etc. These may be viewed as future direction of research work.