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HEALTH SECTOR EFFICIENCY ACROSS INDIAN STATES USING STOCHASTIC FRONTIER ANALYSIS

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ABSTRACT

Health and education are the two most influential variables in determining the human resource development. Human resource development is the backbone of human capital, which in turn is the main driver of the economic growth and development. India has a relatively poor health outcomes compared with the economies of its size because the success in its economic parameters has not been replicated in its health outcomes. The two main reasons responsible for this the low public health spending and poor resource use efficiency. There is a skewed progress in uplifting the health outcomes across Indian States. In some States health outcomes are improving fast while in others the health outcomes have failed to respond even after enhancing the investments hence reflecting their resource use inefficiency. This paper analyses the resource use efficiency in health sector across Indian States using Stochastic Frontier Approach (SFA).

Contribution/ Originality: This study is one of very few studies which have investigated the health sector efficiency using the Stochastic Frontier Analysis. By using the SFA we are able to identify the potential influential variables and then using these variables for the computation of the efficiency scores across different Indian States in the health sector.

1. INTRODUCTION

Human capital as a main source of economic growth and development is of recent past. The dominance of physical capital over the human capital as a determinant of economic growth was overshadowed by the rapid progress of the countries like Japan, Germany and of late China. The spectacular growth of these countries made human resource development a burning topic in academic and policy discussions. It has been observed that globally there is a significant difference between the increase in the national output and the increase in resources responsible for this national output. The major portion of this difference is explained by the investments in human capital (Schultz, 1961). In economics health is regarded as a merit good because it has huge externalities which are not taken into consideration if it is left to the market forces of demand and supply. So, to attain the better health

outcomes government has to come forward to ensure universally accessible and affordable healthcare. The health outcomes of India are not only poor at the international level, huge diversity is observed particularly in maternal and child health outcomes at the interstate level. In the States like Kerala, Tamil Nadu and Maharashtra health outcomes are at par with the developed countries. The Infant Mortality Rate (IMR) of these States is 6, 21 and 24 respectively. In the States like Madhya Pradesh, Uttar Pradesh and Odhissa the IMR is 54, 67 and 43 respectively (International Institute for Population Sciences, 2015). This difference is attributed to many factors but the resource use efficiency is the most significant.

2. REVIEW OF LITERATURE

The outcome of any production process is mainly explained by the resource use efficiency of that production unit. To get the resource use efficiency of any production process, benchmarking finds wide applicability. The two main techniques used for benchmarking analysis are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). In general, certain non medical inputs have a significant impact on the health status of the population particularly in developing economies (Khursheed, 2017). The channel through which such factors influence health is quite diverse. For example, literacy by increasing access to information enhances the utilization of existing medical services and, hence, affects health. Of all the medical inputs, public health expenditure, which signifies the commitment of the State towards improving community health status, undoubtedly has a beneficial impact on health. In India due to NRHM the public health spending has improved and it has reversed the trend of falling public health expenditure (Khursheed, 2017). On the basis of Stochastic Frontier Analysis (SFA), Japan with efficiency score of 0.994 ranked at the top followed by China with the efficiency score of 0.993 India, with the efficiency score of .919 ranked 66th ahead of USA with its efficiency score of 0.914 (Ogloblin, 2011). On the basis of SFA the mean efficiency of the fourteen States during 1986-1995 in India was 0.692. Kerala with a widely recognized commitment towards the development of its social sector and Maharashtra with the fastest growing per capita real income were the two best performers in terms of efficiency in production of health. The economically poor States of Rajasthan, Uttar Pradesh, Madhya Pradesh, and Odhissa were the worst performing States with their efficiency scores of 0.64, 0.40, 0.339 and 0.23 respectively. Bihar despite its backwardness was ranked as the fifth most efficient State. However, Bihar's relatively higher rank in terms of efficiency in health production does not get reflected in its health outcome indicators (Chakrabatty and Rao, 2005).

3. METHODOLOGY

For relative comparison of performance of health sector across different Indian States and to arrive at the relative efficiency of these States; the outcome indicator of IMR and its main determinants like per capita income (PCY), percentage of institutional deliveries, female literacy rate, percentage of women with complete ante natal clinics (ANC) and percentage of households with access to sanitation are used. IMR is chosen as an output variable because it explains 90% variation in life expectancy at birth (LEB) which is a comprehensive measure of health status, the age group of 0-1 years is highly vulnerable; hence determine the health outcomes at the later stages of life. The selection of the determinants is guided by the fact that these determinants are significantly correlated with the IMR. The correlation coefficient between IMR and percentage of institutional deliveries -0.57 and between IMR and female literacy it is -0.71. The choice of IMR as a dependent variable is because of the Availability of data on this indicator and its association with the other health outcomes like maternal mortality rate (MMR) and child mortality rate (CMR). To compare the relative efficiency of different States the Stochastic Frontier Analysis (SFA) is used. The stochastic frontier production model is composed of error structure with a two-sided symmetric term and a one-sided component (Battese and Coelli, 1993). The one sided component reflects inefficiency, while the two sided error captures the random effects outside the control of the production unit. This technique is used to calculate the relative efficiency of different decision making units. In this the best performing unit serves as a

benchmark or a frontier. The efficiency of the other units is judged relative to the frontier. The model used for this analysis is given in equation 1:

$$OI_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + v_i - u_i \quad \ldots\ldots 1$$

Since the objective of every state is to reduce the IMR so for the current analysis the inverse of IMR has been chosen as the outcome variable. X's are the factors contributing to the outcome indicators; X1 is per capita income (PCY), X2 is percentage of pregnant women who received complete antenatal clinics (ANC), X3 is female literacy (LIT) and X4 is percentage of institutional deliveries (INSTDEL). All these independent variables have significant backing of literature in their support. $\beta's$ are the respective coefficients, *vi* is the random error term accounting the unexplained portion of the variation and *ui* is the random variables accounting for the technical inefficiency in production.

4. RESULTS AND DISCUSSION

The results obtained from frontier 4.1 are given in Table 1 and 2. From the results it is clear that PCY and female literacy are most important determinants of IMR in Indian States with coefficients of 0.99 and 0.91 respectively. The coefficients of complete ANC and institutional deliveries are 0.17 and 0.11 respectively. With regard to the efficiency of the States Kerala and Goa are the best States with their efficiency score of .97 and hence serve as frontier. The efficiency scores of worst performing States are Bihar (0.79), Madhya Pradesh (0.84), J&K (.89), Jharkhand (0.87) and Uttar Pradesh (0.84).

This difference in the health outcomes across different regions is because of the difference in the determinants of these health outcomes. The main determinants of maternal and child health outcomes are sanitation and access to safe drinking water, poverty, nutritional level of expecting mothers, antenatal care, institutional deliveries, female literacy. Even today huge difference is seen across different States. Households having access to safe drinking water in Telangana is 98.2% and in Madhya Pradesh it is 84.7% (NFHS 4, 2015-16). Households having access to improved sanitation in Telangana is 77.6% and in Bihar it is 25.2%. Female literacy rate which encompasses so many dimensions is an important determinant of IMR and MMR. There is significant variation in female literacy across different States Poor nutrition and poor antenatal care are the main determinants of IMR and MMR. It ranges from 50% in Bihar to 91% in Kerala. Per capita income which reflects the standard of living varies from thirteen thousand in Bihar to one lakh twenty nine thousand in Goa. Similarly percentage of women who receive full Antenatal Care (ANC) ranges from 3.3 in Bihar and 45 in Tamil Nadu. Percentage of women who have low Body Mass Index (BMI) ranges from 30.4 in Bihar and 14.6 in Tamil Nadu. In order to improve the overall health scenario in the poor performing States the investments in social sectors needed to be enhanced because in the developing regions these investments have more forward and backward linkages.

5. CONCLUSION

Non medical factors like female literacy and sanitation are still the most significant factors in improving the health outcomes in India. The determinants falling in the social domain are influential in improving the efficiency of health outcomes in India because India has still large chunk of population is living below poverty line. In India the dominance of private healthcare is because it is very remunerative for the suppliers and costs huge sums of money for the patients. The main lacuna of increasing privatization of health care in India is its negligence of the preventive aspect of total health.

Table-1. MLE Estimates of Coefficients

	Coefficient	Standard-error	T-ratio
β0	-0.□44	0.1000000	-0.44430864
β1	0.998	0.1000000	1.99876906
β2	0.177	0.1000000	2.17758100
β3	0.913	0.1000000	1.91312247
β4	0.117	0.1000000	2.11729437

Author's estimation using frontier 4.1

Table-2. State wise IMR its Selected Determinants and relative efficiency in India 2012

State	IMR	PCY	ANC	LIT	INSTDEL	Eff. est.
Andhra Pradesh	41	38556	85.4	51.54	93.14	0.906
Arunachal Pradesh	33	35527	35.5	52.04	95.02	0.884
Assam	55	21741	39.3	63.03	83.03	0.901
Bihar	43	13149	17.0	49.0	75.97	0.798
Chhattisgarh	47	27163	54.2	55.06	61.59	0.882
Delhi	25	106677	75.1	73.1	94.27	0.943
Goa	10	129397	94.9	81.63	99.66	0.966
Gujarat	38	56634	67.5	61.36	95.10	0.921
Haryana	42	61716	59.2	60.02	83.58	0.914
Himachal Pradesh	36	49203	62.6	74.62	75.50	0.932
J&K	39	28790	73.5	51.64	87.52	0.898
Jharkhand	38	25265	35.9	48.91	71.00	0.842
Karnataka	32	41492	79.5	59.71	98.08	0.923
Kerala	12	52808	93.6	90.81	99.79	0.962
Madhya Pradesh	56	23272	40.7	52.43	85.22	0.870
Maharashtra	25	61276	75.1	68.54	96.33	0.937
Manipur	10	22169	68.6	68.89	76.14	0.950
Meghalaya	49	34232	54.0	68.37	51.13	0.912
Mizoram	35	37921	59.3	79.81	86.35	0.936
Nagaland	18	46340	32.7	71.51	73.02	0.934
Odisha	53	24542	61.8	60.74	86.91	0.907
Punjab	28	46325	74.8	65.74	82.77	0.929
Rajasthan	49	29612	41.2	45.8	92.28	0.845
Sikkim	24	73704	70.1	72.45	88.62	0.940
Tamilnadu	21	57093	95.9	65.05	99.83	0.940
Tripura	28	39608	60.0	79.49	86.25	0.939
Uttar Pradesh	53	18014	26.6	53.65	62.67	0.843
Uttarakhand	34	52606	44.9	66.18	71.65	0.918
West Bengal	32	32164	62.0	65.51	73.32	0.920

Author's estimation using frontier 4.1:

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