Health Infrastructure & Economic Growth in Haryana: An Econometric Approach

Abstract

Health is an essential factor for the human resource development and is very critical ingredient to economic growth. The worldwide emphasis on human resource development has necessitated particularly the developing countries to pay greater attention to health infrastructure as health and human resource development are closely related. Health infrastructure is universally recognized as an important part of social infrastructure. Moreover, the status of health depends upon the health spending in the economy. Therefore, public expenditure on health infrastructure assumes a greater significance in developing countries like India including Haryana as a most progressive State because of the growing population and ever increasing demand for health services. It is a valuable investment which helps in building and maintaining a productive labor force as well as in improving the lives of the people and quality of the society. Keeping in above backdrop the present study is an attempt to examine the relationship between health infrastructure and economic growth for the State of Haryana by applying distributed lag model approach. For this purpose, gross state domestic product (GSDP) & public expenditure on health (PHE) are considered as the indicators of economic growth & health infrastructure respectively. The study confirms that health infrastructure leads to economic growth significantly. Therefore, to sustain the contribution of health infrastructure in economic growth, Government must increase its spending on health infrastructure every year.

Keywords: Health Infrastructure, PHE, GSDP, Haryana.

Introduction

Health is an essential factor for the human resource development and is very critical ingredient to economic growth. The worldwide emphasis on human resource development has necessitated particularly the developing countries to pay greater attention to health infrastructure as health and human resource development are closely related. Health infrastructure is universally recognized as an important part of social infrastructure. Moreover, the status of health depends upon the health spending in the economy. Therefore, public expenditure on health infrastructure assumes a greater significance in developing countries like India including Haryana as a most progressive State because of the growing population and ever increasing demand for health services. It is a valuable investment which helps in building and maintaining a productive labor force as well as in improving the lives of the people and quality of the society. There are strong evidences from both developed and developing countries that public expenditure on health infrastructure leads to the sustained economic growth.

Health is a state of complete physical, mental, spiritual and social well-being and not merely an absence of disease and infirmity. The relationship between health and economic growth has been on the focus of economists since the second half of the last century. The Commission on Macroeconomics and Health (CMH) at the World Health Organization in its report emphasized that improvements in health are important for economic growth (Macroeconomics and Health 2001). Keeping in above backdrop, the study has been organized as follows: Section II is dedicated on the review of concerned literature. Section III describes the data and methodology and Section IV provides an analysis of health infrastructure & discusses the empirical findings and lastly, Section V concludes the study with policy implications.

Review of Literature

The relationship between health and economic growth has been discussed by economists and researchers in both developed as well as developing countries, so there is no dearth of literature on the issue of health infrastructure and economic growth. Over the last three decades, a number of studies found a strong and

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positive relationship between national income and health care expenditure (Kleiman, 1974; Newhouse, 1977, 1987; Leu, 1986; Parkin et al, 1987; Pritchett and Summers, 1996; Filmer and Pritchett, 1999). To justify the need of the present study, following literature has been reviewed:

Hitiris and Posnett (1992) used 560 pooled time series and cross section observations from 20 OECD countries over the period 1960-1987 and found a strong and positive correlation between per capita health spending and GDP.

Goel and Ahlawat (1993) analyzed growth of health expenditure, existing infrastructure for health, medical staff and patients treated in hospitals and dispensaries in Haryana and emphasized investment in health sector for creating health culture in country. They concluded that better health and medical care services for the rural and poor people can be provided through proper health planning.

Fogel (1994) concluded that approximately one third of income growth in Britain during 1790-1980 may credited to improvements in health facilities and better nutrition. Study also concluded that public health and medical care must be recognized as labour-enhancing technological change.

Sachs and Warner (1997) by using life expectancy as indicator of health, found a quadratic relationship between health human capital and economic growth. Their study concluded that health human capital increases economic growth at a decreasing rate.

Jamison (2003) found that better health accounted for 11 per cent of growth. Study concluded that investment in physical capital, education and health plays critical role in boosting the economic growth.

Gupta and Mitra (2004) examined the relationship among health, poverty and economic growth in India for the years 1973-74, 1977-78, 1983-84, 1987-88, 1993-94 and 1999-2000 based on data for 15 Indian states along with time series analysis in each of the states. Their findings suggested that per capita public health expenditure positively influences health status that poverty declines with better health and that growth and health have a positive two-way relationship.

Duraisamy and Mahal (2005) examined the determinants of economic growth and health using panel data of 14 major India states for the period 1970/71-2000/01 and found two-way causation between economic growth and health status.

Weil (2007) suggested that health's positive effect on GDP is strongest among poor countries. For rich countries, the existing empirical evidence on whether health capital formation stimulates GDP growth is mixed.

Goel and Garg (2011) examined the causal relationship between public expenditure on health and economic growth in Haryana for the period 1991-92 to 2007-08 by using granger causality test and found the existence of uni-directional causal relation between public expenditure on health and economic growth. And the direction of causality was to be found from economic growth to public expenditure on health but the reverse causality was absent.

The above literature shows that the various studies have been conducted in relation to health and economic growth. It is clear from the studies that there is long run relationship between health and economic growth. It is evident from the above literature that investment in health infrastructure is the key requirement for the development of any economy including Haryana.

Data & Methodology

The present study is exclusively based on secondary data which has been collected from the various issues of Statistical Abstract of Haryana published by Government of Haryana. The study considers the time period from 1991-92 to 2011-12. To review the major indicators of health infrastructure in Haryana, the available data have been processed and presented in suitable tables.

In order to examine the relationship between health infrastructure and economic growth, public expenditure on health (PHE) is used as a proxy for health infrastructure and gross state domestic product (GSDP) for economic growth. And this relationship can be analyzed through simple linear regression model of the form as follows

$$GSDP_t = \alpha_0 + \alpha_1 PHE_t + U_t \ \ldots\ldots\ldots (I)$$

The above model (I) depicts that current year public expenditure on health influences the current year GSDP and it has no time lag. Since, expenditure on health does not yield immediate return to the economy. Therefore, to identify the time lag, through the explanatory power of the independent variable, viz, public expenditure on the health, we should run regression models with varying time lag. Hence the following distributed lag model is used

$$GSDP_t = \alpha_0 + \alpha_1 PHE_{t-k} + U_t \ \ldots\ldots\ldots (II)$$ Where, k=1, 2, …., 12

The above model depicts that GSDP of period 't' depends on PHE of period 't-k' where k goes from 1 to 12. In above model GSDP is regressed on each PHE individually through Ordinary Least Square (OLS).

Analysis Of Health Infrastructure In Haryana

Health infrastructure is the resources needed to deliver the essential health care services. Availability and quality of health infrastructure is one of the major factors that influence health. In order to achieve the goal of "Health for All" by the end of 2020 A.D., a comprehensive health care infrastructure is required.

Haryana is one of the most progressive States in Indian economy. After coming into existence as a separate State in 1966, Haryana has made an appreciable progress in health infrastructure. In 1968, there were only 785 medical institutions (out of which 656 were rural and 129 were urban) which increased to 3244 (out of which 2953 were rural and 291 were urban) in 2011-12. The number of total medical staff was only 3312 in 1966 but in 2011-12 it reached to 13185. There were only 8 institutions per one lakh of population in 1968 but in 2011-12, the institutions have increased to 13 per one lakh population. Ayurvedic, unani and homeopathic institutions have increased from 143 in 1966-67 to 508 in 2011-12. Medical personnel in these institutions have also increased from 286 in 1966-67 to 878 in 2011-12.

Due to the expansion of health facilities, the health status of people in Haryana has improved since 1966. The life expectancy of male and female has increased to 65.50 and 70.00 years respectively

in 2011 in Haryana while for whole India life expectancy is found to be 64.6 and 67.7 years for male and female respectively. Birth rate and death rate has improved and stood at 22.3 and 6.6 per thousand respectively in 2010-11 as against 33.34 and 9.21 per thousand respectively in 1966. Similarly,

infant mortality rate and maternal mortality ratio has also reduced to 48 per thousand and 153 per one lakh live births respectively in 2010-2011. The performance of health infrastructure during 1991-92 to 2011-12 by considering important indicators, is presented in the following table 1

Table 1
Performance of Health Infrastructure In Haryana

Year	Doctor/ Nurse Ratio	Doctor/ Population Ratio	Doctor/Patient Ratio	Doctor/Bed Ratio	Bed/Patient Ratio
1991-92	1:2.92	1:12091.23	1:5561.67	1:7.73	1:719.09
1992-93	1:2.86	1:12230.87	1:6012.48	1:7.99	1:752.23
1993-94	1:2.70	1:11752.68	1:5175.54	1:7.63	1:678.43
1994-95	1:2.57	1:11663.20	1:4981.85	1:7.33	1:678.90
1995-96	1:2.33	1:12129.03	1:5126.57	1:7.46	1:687.44
1996-97	1:2.49	1:12592.66	1:5670.14	1:7.55	1:750.81
1997-98	1:2.29	1:12213.11	1:5553.43	1:7.19	1:771.53
1998-99	1:2.41	1:12455.79	1:5823.24	1:7.17	1:811.89
1999-00	1:2.57	1:14404.24	1:6611.34	1:7.69	1:859.99
2000-01	1:2.32	1:12990.06	1:6025.63	1:6.76	1:891.82
2001-02	1:2.23	1:13375.07	1:5382.14	1:6.82	1:789.32
2002-03	1:2.10	1:12337.28	1:4512.94	1:6.24	1:723.28
2003-04	1:2.15	1:12124.65	1:5382.39	1:6.03	1:892.21
2004-05	1:2.03	1:12421.77	1:5945.36	1:6.06	1:980.69
2005-06	1:1.85	1:12582.93	1:6354.04	1:5.21	1:1219.23
2006-07	1:2.58	1:15225.45	1:8435.99	1:6.21	1:1358.32
2007-08	1:2.84	1:16653.02	1:8720.37	1:6.85	1:1273.67
2010-11	1:2.59	1:16430.43	1:9928.18	1:6.51	1:1526.04
2011-12	1:2.56	1:16124.29	1:9585.06	1:6.30	1:1522.64

Source: Statistical Abstract of Haryana, Various Issues.
Table 1 reveals that doctor/nurse ratio has declined over the years. There were 2.92 nurses behind one doctor in 1991-92 but in 2011-12, the number of nurses declined to 2.56 per one doctor. Thus, doctor/nurse ratio in Haryana is found to be less than the ideal doctor/nurse ratio i.e. 1:3 recommended by World Health Organization (WHO). However, doctor/population ratio seems to be insignificant as there was one doctor for the population of 12091.23 in 1991-92 but the population has increased to 16124.29 for one doctor in 2011-12. This reveals the shortage of doctors in Haryana. Similarly, there was one doctor behind 5561.67 patients in 1991-92 while in 2011-12 there was one doctor behind 9585.06 patients. This implies doctor/patient ratio in Haryana is falling much short of the standard doctor/patient ratio i.e. 1:600 set by WHO. There was one doctor for 7.73 beds in 1991-92 but in 2011-12 there was one doctor for 6.30 beds

& Figures are based on Authors' calculations. which is the sign of improvement in doctor/bed ratio. Similarly the trend of bed/patient ratio highlights the shortage of beds for patients in the State.

If economic growth of a country has to be sustained, the health infrastructure has to be better in quantitative as well as qualitative terms. Thus, public expenditure on health infrastructure is justified. Public expenditure on health infrastructure in Haryana has been increasing since 1966. Public expenditure on health infrastructure in Haryana is increased from ₹ 164.49 crores in 1991-92 to ₹ 3393.48 crores in 2011-12. However, the share of public expenditure on health infrastructure in total public expenditure was 6.80 per cent in 1991-92 and 8.93 per cent in 2011-12. The trend of public expenditure on health infrastructure in Haryana for the period 1991-92 to 2011-12 is shown in following table 2

Table 2
Growth of Public Expenditure on Health Infrastructure in Haryana (Expenditure In ₹ Crore)

Year	Development Revenue Expenditure on Health	Capital Expenditure on Health	Public Expenditure On Health
1991-92	155.92 (10.39)	8.57 (5.87)	164.49 (6.80)
1992-93	171.10 (10.55)	38.10 (16.69)	209.20 (8.02)
1993-94	198.64 (11.34)	44.54 (14.70)	243.18 (6.56)
1994-95	336.18 (12.09)	58.97 (28.55)	395.15 (6.10)
1995-96	267.34 (9.59)	62.86 (21.99)	330.20 (5.85)
1996-97	300.30 (9.71)	178.26 (39.9)	478.56 (6.63)
1997-98	373.92 (11.14)	111.91 (22.74)	485.83 (6.83)
1998-99	474.19 (11.18)	120.05 (11.70)	594.24 (7.39)
1999-00	506.03 (12.50)	142.04 (15.88)	648.07 (8.26)
2000-01	510.32 (12.60)	133.30 (9.22)	643.62 (7.46)

2001-02	571.96 (11.13)	181.40 (12.36)	753.36 (7.44)
2002-03	646.37 (12.10)	201.18 (46.16)	847.55 (8.67)
2003-04	703.90 (12.34)	273.79 (70.99)	977.69 (9.31)
2004-05	692.25 (10.79)	264.43 (29.48)	956.68 (7.77)
2005-06	806.20 (10.32)	392.22 (24.33)	1198.42 (8.40)
2006-07	859.08 (7.64)	585.50 (22.41)	1444.58 (7.61)
2007-08	1078.34 (9.02)	734.28 (19.78)	1812.62 (8.53)
2010-11	1934.6 (6.83)	716.67 (15.08)	2651.27 (8.02)
2011-12	2534.28 (7.92)	859.20 (14.32)	3393.48 (8.93)

Source: Statistical Abstract of Haryana, Various Issues.

Note: Figure in parentheses in Column 2,3 & 4 are the percentage share of Total Revenue expenditure, Total Capital expenditure & Total public expenditure respectively.

The above table 2 shows that public expenditure on health including development revenue expenditure and capital expenditure has increased in Haryana over the years. The percentage shares of capital and public expenditures on health in total capital and public expenditures has increased in 2011-12 in comparison to 19991-92. While percentage shares of development revenue expenditure on health in total development revenue expenditure has declined from 10.39 per cent in 1991-92 to 7.92 per cent in 2011-12. Capital expenditure on health has increased at the compound annual growth rate of 22.5 per cent which is highest in comparison with the revenue and public expenditures on health in State of Haryana. Thus, to achieve equity, efficiency and sufficiency in health infrastructure, there is a strong case to enhance the Government spending on health infrastructure in Haryana.

To investigate the relationship between health infrastructure and economic growth in Haryana, distributed lag model has been used and its results are shown in the following table 3

Table 3: Results Of Lagged Regression Model

Time Lag (K)	α_0	α_1	SEα_1	t-statistic	R2	Adj.R2	R	F-value
1	-5961.29	108.27*	4.27	25.37	0.979	0.977	0.989	643.48
2	-6881.38	124.73*	7.62	16.37	0.954	0.950	0.977	268.00
3	-6043.23	138.80*	11.14	12.46	0.928	0.922	0.963	155.14
4	-2601.92	147.03*	10.28	14.31	0.949	0.944	0.974	204.65
5	-742.07	162.40*	14.36	11.31	0.927	0.920	0.963	127.83
6	2821.02	174.95*	19.60	8.93	0.899	0.887	0.948	79.72
7	8011.04	185.47*	24.06	7.71	0.881	0.867	0.939	59.43
8	14945.57	191.47*	21.61	8.86	0.918	0.906	0.958	78.49
9	20547.13	206.24*	27.94	7.38	0.901	0.884	0.949	54.49
10	25396.57	228.34*	40.58	5.63	0.864	0.836	0.929	31.67
11	36472.49	230.77**	52.39	4.41	0.829	0.786	0.911	19.40
12	43466.29	260.17***	90.42	2.88	0.734	0.645	0.857	8.28

* indicates at 1% level of significant; ** indicates at 2% level of significant; *** indicates at 10% level of significant

The results of lagged regression model are discussed as follows:

- The results of distributed lag model states that regression coefficient (α_1) is relatively smaller in the initial stages and is increasing with the rising time lag. The regression coefficient is statistically significant which implies PHE is important variable affecting the GSDP, in each time lag. The highest value of t-statistic is 25.37, when k=1.
- Standard error is an indicator of the variance of the parameter. The standard error of parameter (α_1) is relatively low i.e. 4.27 when k = 1. Therefore, the model having lagged one is the best.
- To measure the 'goodness of fit' of the model, R^2 and adjusted R^2 are used. The highest value of R^2 and adjusted R^2 are 0.979 and 0.977 respectively when k =1.This implies PHE is capable of explaining 98 per cent of variations in GSDP.

- Correlation coefficient (R) is around 0.9 in all the time lags. This implies that in each time lag PHE is significantly related with GSDP. Correlation coefficient is highest 0.989 when the time lag is 1 year. Hence the degree of co-variation between GSDP and the PHE is the highest when the time lag is 1.
- To judge the overall significance of the model, F-statistic is used. F-statistic is found to be significant in each time lag. This implies PHE is significant explanatory variable in each time lag. The F statistic touches the highest value i.e. 643.48 when the time lag is 1.

The results of this model indicate that PHE is positively related to GSDP of India when time lag ranges between 1 to 12 years and the relationship between the two is found to be highly significant when time lag is of one year. It can be concluded that there is a significant relationship between past values of PHE and GSDP. Thus the results of this regression suggest that PHE do lead to economic growth. It can also be seen from the study that public expenditure on health requires one year for making its positive impact on GSDP at the highest level for Haryana during the

period under investigation. Therefore, the inference can be drawn from the study that health infrastructure promotes economic growth.

V. Conclusion & Policy Implications

It can be concluded that health infrastructure is an essential factor for economic growth. Haryana has attained much improvement in health facilities since its inception, but it is not so sufficient according to the need of growing population in the State. The study reveals the presence of positive relationship between health infrastructure and economic growth in Haryana. Therefore, to sustain the contribution of health infrastructure in economic growth, Government must increase its spending on health infrastructure every year.

The important role of health infrastructure in enhancing economic growth emphasizes that health infrastructure should be undertaken as basic infrastructural activity. The Government expenditure on health infrastructure should not be treated under social services sector and calls for separate head to be treated as investment. Government should devote a sufficient amount of expenditure on health infrastructure to improve the doctor/population ratio, doctor/ patient ratio, doctor/nurse ratio, doctor/bed ratio & bed/patient ratio and to follow the WHO recommendations on health care. However, it is also necessary that spending on health infrastructure should be properly utilized such that it benefits the entire population, especially the under privileged. In order to increase the contribution of health infrastructure in economic growth there is rationale for good governance in health sector so that financial leakages and wastages can be plugged. Last but not least, to bring efficiency, sufficiency and equity in health care system in Haryana, the Public Private Partnerships (PPP) in health sector is need of the hour.

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