Healthcare Sector: Cross Country Analysis, Correlation Study And Assessment of Investment Opportunities in The Context of Indian Market

Avik Ghosh
CMA, B.E. (Electrical)
JAIIB, CAIIB, Diploma in Investment Law

Abstract- *The research objective was to unveil various aspects of healthcare sector that includes comparative cross-country analysis with special focus on globally-accepted key indicators. The subsequent comparison of developing nations with OECD countries reflected the improvement areas for China, Brazil and India. The remaining research was focused on India- the need to have higher per capita health expenditure and more budgetary contribution to healthcare sector which in turn may even improve various key health indicators. It was tested for Infant Mortality Rate and Life Expectancy at Birth through correlation and regression analysis where the conclusion was highly encouraging. The scope in Indian market was further elaborated by discussing multiple opportunities available with this fledgling sector. It was clearly depicted that the requirement of better health indicators in India depends strongly on higher sectoral investment and better government support. This conclusion fell in line with the growth projection for healthcare sector that conceptualises a remarkable growth trajectory in years to come.*

Keywords- Healthcare Sector, Private Investment in Healthcare, Correlation and regression study of healthcare parameters, Healthcare opportunities in India.

I. INTRODUCTION

When the global equality and inclusivity in basic parameters are discussed, it is ascertained that healthcare sector needs clear attention to improve the scenario. Considerable difference between OECD countries and the developing countries (Brazil, India and China are considered in this paper) in various parameters namely per capita healthcare expenditure, expenditure as % of GDP etc. project a picture to ponder over. High Income Group countries can afford to have 326 full time equivalent (FTE) health researchers per million inhabitants whereas it is only 56 and 8.7 respectively for Lower-middle and Low income countries (Figure 1). Another key status indicator, doctors per thousand inhabitants has been assessed as only 0.8 for India and 2 for China whereas it is as high as 4 and 4.3 for OECD countries Italy and Germany respectively (Figure 2). Although global investment in research and developmental work in healthcare innovation increased substantially from $2863 million to $3566 million between 2007 and 2018 (Figure 3), the lion's share of this came from the developed countries resulting in ever-increasing gap in the outcome indicators with the developing and underdeveloped countries. As the picture looks grim and gloomy for the countries with poor indicators, the scope of improvement is huge. In case of India, it has been assessed that it will be ranked amongst the top three in terms of incremental growth in healthcare sector and its healthcare market has the potential to see a threefold rise to $372 billion by 2022. The key driving parameters for future market growth in the sector- healthcare information technology, diagnostics and in-patient market are expecting strong growth in next five years resulting in a capable forecasted market potential for India.

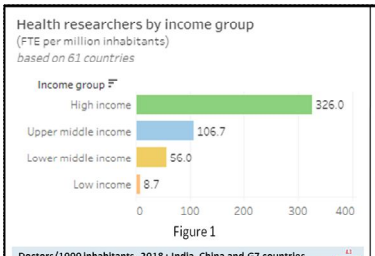

Figure 1

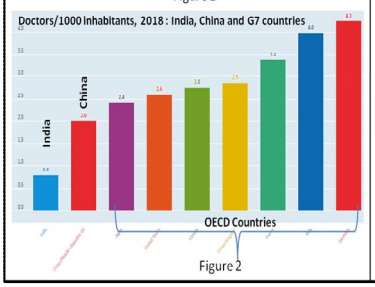

Figure 2

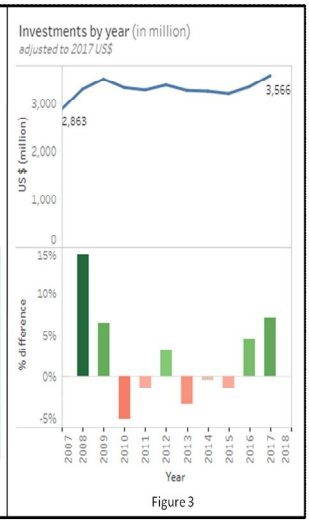

Figure 3

II. PREVIOUS RESEARCH

Various valuable research work has been performed in assessing the healthcare sector and its potential. Some of those were performed with special interest on developing

nations. Cadilhac, D.A., Magnus, A., Sheppard, L., Cumming, T.B., Pearce, D.C. and Carter, R., in 2011, and Charlesworth, A., Davies, A. and Dixon, J., in 2012, contemplated the payment profile in healthcare sector. They also found out the investment propositions in this sector with economic modeling that resulted in forecasting the future market profile. Gallego, G., Haas, M., Hall, J. and Viney, R., in 2010, and Larsson S., Lawyer P., Garellick G., Lindahl B. and Lundstrom M., in 2012, pointed out the requirement of government intervention in the sector. They also mooted the contribution of private players and its positive impact in healthcare industry along with government incentives.

In OECD (Organisation for Economic Co-operation and Development) 2013, Health at a Glance 2013, Paris, the focus covered a wider range of healthcare inequality, disparity and other issues with its probable way outs. Cropper, M.L., in 1977, and Grossman, M., in 1972, derived a relationship between capital investments in healthcare sector with its probable developmental outcome.

Various studies have been performed in the context of India. Rao, Sujatha K.; Selvaraju, S.; Nagpal, Somil; and Sakthivel, S., in 2005, and Choudhury, Mita, in 2006, analyzed the effect of investment, both public and private, in the changing scenario of healthcare segment. Their focus was restricted mostly to developing countries with special emphasis on India. The outcome of the researches was encouraging due to its forecasted suggestion to improve private contribution under government framework. The health insurance schemes and its effectiveness were also pondered over. In 2005, Das Gupta, M. and in 2015, Sehgal, S. and S. Hooda not only asserted the role of healthcare and scope of its investment opportunities in the overall economy of the country but also reiterated the trend, pattern and implication of various investment type in the outcome. All these studies were mostly qualitative in nature with suitable quantitative inclusion. This research paper talked about a proven regression model to fetch the relationship amongst the variables or indicators.

III. INITIAL THEORETICAL FRAMEWORK AND METHODOLOGY

This research work aimed at initially verifying the comparative difference in status of various parameters in health investment and expenditures namely per capita current health expenditure, domestic private health expenditure (% of total health expenditure), current health expenditure (% of GDP) etc. for Brazil, China, India and OECD countries. The comparative analysis guided the research to trace the relationship between the health expenditure parameters with its developmental outcome namely Infant Mortality Rate and Life Expectancy at Birth. Correlation and Regression analysis have been performed to fetch the said relationship for India. Subsequently, the conclusion was drawn that these key developmental indicators strongly depend on the expenditure and investment quantum. This study further guided the research to figure out the scope and market potential in healthcare sector. The opportunities in the sector then analyzed for India with a well-defined roadmap that emanates a brighter future for this potential industry.

IV. PRESENTATION OF DATA AND EXPLANATION

As explained in the research methodology, the initial assessment was performed through comparative analysis for various expenditure and investment related sectoral parameters. As per 2016 data, domestic private health expenditure has been found as 73.5% of total health expenditure in case of India whereas it is only 42% for China and as low as 20.1% for OECD countries (Table 1) depicting the dependency of more private services due to lesser government support / mechanisms in this sector. The change in the scenario is almost negligible for India and Brazil, but China and OECD countries have improved by approximately 50%. Similar outcome has been obtained when the per capita current health expenditure (PPP) was assessed. As per 2016 data, the per capita expenditure value for China, Brazil and OECD countries are respectively three, seven and twenty times (Table 2) higher than that of India. This is an area of concern where the stakeholders, especially government, need to be extra-careful. Similar analysis was subsequently done for health expenditure as % of GDP and outcome was

Domestic private health expenditure (% of current health expenditure)					
Country Name	**2000**	**2004**	**2008**	**2012**	**2016**
Brazil	74.1	57.6	55.4	64.4	66.7
China	78.0	69.6	55.3	44.2	42.0
India	76.6	79.8	75.5	71.1	73.5
OECD members	40.2	39.3	37.3	36.0	20.1

Table 1

Current health expenditure per capita, PPP (current international $)					
Country Name	**2000**	**2004**	**2008**	**2012**	**2016**
Brazil	591.4	837.5	1075.8	1545.8	1777.5
China	129.5	188.1	292.1	507.8	761.5
India	82.3	104.0	131.9	163.7	241.5
OECD members	2309.5	3001.6	3737.6	4354.6	5040.8

Table 2

equally alarming. India committed 3.66% expenditure in healthcare whereas OECD members contributed more than 12% (Table 3). China, with nearly five

times India's GDP and nearly equal population, contributed almost 5% of its GDP in healthcare.

Current health expenditure (% of GDP)					
Country Name	**2000**	**2004**	**2008**	**2012**	**2016**
Brazil	6.56	8.06	8.12	10.04	11.77
China	4.47	4.26	3.88	4.55	4.98
India	4.03	3.96	3.51	3.33	3.66
OECD members	9.32	10.38	10.71	11.80	12.59

Table 3

Mortality rate, infant (per 1,000 live births)					
Country Name	**2000**	**2004**	**2008**	**2012**	**2016**
Brazil	30.40	23.60	18.40	15.40	14.60
China	30.10	22.20	15.80	11.60	8.50
India	66.60	57.80	49.40	40.90	33.20
OECD members	10.58	8.78	7.47	6.57	5.88

Table 4

In continuation with the earlier comparative analysis, it was found to be imperative that these parameters would have direct impact on the developmental indicators. Hence, a study was performed considering two key outcome indicators for India namely infant mortality rate and life expectancy at birth. Both the indicators were regressed with the input parameters namely per capita current health expenditure (PPP) and health expenditure as % of GDP. The data for all the said parameters have been tabulated in Table 5 where 17 data points have been observed and analysed for testing the following hypothesis: null Hypothesis H_0: There is no linear relation between output indicators (infant mortality rate or life expectancy at birth) and input variables (per capita current health expenditure (PPP) and health expenditure as % of GDP) and alternate hypothesis H_1: There is a linear relationship between the variables. The correlation study was also performed in this regard.

Healthcare Data: India				
Year	Per Capita Expenditure	Expenditure (% of GDP)	Infant Mortality Rate	Life Expectancy @Birth
2000	82.29	4.03	66.60	62.51
2001	91.61	4.26	64.30	62.91
2002	94.43	4.24	62.10	63.30
2003	96.59	4.01	59.90	63.70
2004	104.04	3.96	57.80	64.10
2005	110.66	3.79	55.70	64.50
2006	117.65	3.63	53.60	64.92
2007	126.42	3.52	51.50	65.35
2008	131.85	3.51	49.40	65.79
2009	140.90	3.49	47.30	66.24
2010	145.63	3.27	45.10	66.69
2011	150.50	3.25	43.00	67.13
2012	163.69	3.33	40.90	67.55
2013	196.86	3.75	38.90	67.93
2014	205.89	3.62	36.90	68.29
2015	221.76	3.60	35.00	68.61
2016	241.48	3.66	33.20	68.90

Table 5
(Source: World Bank Data)

The correlation matrix for all the variables clearly states that per capita expenditure is inversely correlated with infant mortality rate and directly correlated with life expectancy at birth. The correlation coefficients of -0.96 and 0.958 show that the degree of the correlation and inverse correlation are considerably high enhancing the acceptability of the regression model. Table 6 consists of the correlation and regression statistics for life expectancy at birth with the quantified input parameters. The R square result of 0.987 and the high t statistics for all the input variables establish the veracity of the model. The extremely low P-values for all the input variables reiterate the acceptance of the model at even 1% significance level. Hence the null hypothesis can be rejected and alternate hypothesis can be accepted resulting in a linear relationship of the output developmental variable with the input variables.

Regression Statistics	
Multiple R	0.9935
R Square	0.9870
Adjusted R Square	0.9851
Standard Error	0.2544
Observations	17

Correlation Coefficients

	PC Exp	*Exp (% of GDP)*	*IMR*	*Life Ex@Birth*
PC Exp	1			
Exp (% of GDP)	-0.5052	1.0000		
IMR	-0.9604	0.7061	1.0000	
Life Ex@Birth	0.9583	-0.7103	-0.9997	1

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	68.5403	34.2701	529.4413	0.0000
Residual	14	0.9062	0.0647		
Total	16	69.4465			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	68.3771	1.0035	68.1367	0.0000	66.2247
PC Exp	0.0345	0.0015	22.7510	0.0000	0.0313
Exp (% of GDP)	-2.0293	0.2364	-8.5858	0.0000	-2.5362

Table 6

When similar regression modelling was performed for infant mortality rate, the R square appeared to be 0.988 (Table 7) that even strengthened the applicability of the regression model. Significantly high t statistics and extremely low P-value authenticate the linear model at 1% or even lower significant level resulting in the rejection of null hypothesis and acceptance of alternate hypothesis. Both the analysis complemented each other with a generalized conclusion that both the developmental indicators are significantly impacted by the input variables.

Regression Statistics	
Multiple R	0.994
R Square	0.988
Adjusted R Square	0.986
Standard Error	1.246
Observations	17

Correlation Coefficients

	PC Exp	Exp (% of GDP)	IMR	Life Ex@Birth
PC Exp	1			
Exp (% of GDP)	-0.5052	1.0000		
IMR	-0.9604	0.7061	1.0000	
Life Ex@Birth	0.9583	-0.7103	-0.9997	1

ANOVA

	df	SS	MS	F	Significance F
Regression	2	1772.253	886.127	570.870	0.000
Residual	14	21.731	1.552		
Total	16	1793.985			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	37.394	4.914	7.609	0.000	26.854
Per Capita Expenditure	-0.177	0.007	-23.781	0.000	-0.193
Expenditure (% of GDP	10.073	1.157	8.703	0.000	7.591

Table 7

This conclusion led the research to ponder over opportunities available in the Indian market. The government initiatives, policy incorporation and planned execution had ensured considerable scope for the healthcare companies. Government investment in R&D activities may act as a game changer along with the consolidated health insurance plan 'Ayushman Bharat'.

4.2. Source of Data

The above analysis was based on data available at various sources. The World Bank common database was used for the input and output variables (infant mortality rate, life expectancy at birth, per capita current health expenditure (PPP) and health expenditure as % of GDP). The initial assessment data for availability of doctors, investment in healthcare R&D, number of researchers in the sector have been obtained from WHO database. The future roadmap for the industry and the expected contribution of the government has been assessed from 'investindia' database of GOI.

4.3. Scope and limitations of research

The research work covers wider range of analysis incorporating data of multiple input indicators and some specified output variables. The same activity could have been converted to more sacrosanct if would have been tested with few more developmental indicators. Additionally the research could have been more dynamic if monthly data of the indicators would have been obtained. That could result in a possibility of time series modeling with considerably higher number of data points. The research, within its objective oriented and targeted scope, had established the desired relationship and subsequently concluded with the necessary hypothesis.

V. CONCLUSION

This research work is a representation of a methodical process of finding a desired opportunity starting with goal-definition, subsequent analysis of available data and regression modelling with the information and ended with a logical conclusion through multifarious hypothesis verification. As it has been ascertained that the developmental indicators in healthcare segment are strictly correlated with the investment and expenditure variables in India, the opportunity of healthcare sector is also worth mentioning. The hospital industry is expected to grow at a CAGR of 16-17% in India and the forecasted revenue FY2022 is more than $130 billion. Healthcare related IT industry is expected to grow to $1.5 billion by 2020 whereas in-patient market growth is more than 14%. Automatic route permits 100% FDI in Greenfield projects whereas the brownfield projects permit up to 100% FDI through government route. Figure 4 has highlighted various pillars that transformed India to advantageous position regarding healthcare investment. The BSE healthcare index (Figure 4) had depicted the manifold growth of the sectoral index since 2000. The nearly 650% growth in 18 years has

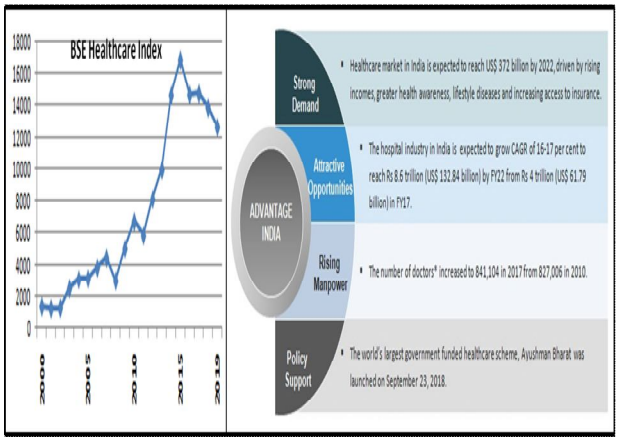

Figure 4

many stories to share. This reflects the capability of healthcare stock to grow and deliver excellent outcome for their shareholders through profitability. As we are discussing the potential of the sector, it is undoubtedly accepted that huge infrastructural investment projection, higher life expectancy, increasing medical tourism, more ICT application and higher public awareness (Figure 5) are the game-changers for the sector. The introduction of world's largest government funded health insurance scheme 'Ayushman Bharat' may not only improvise the developmental aspect but also redefine the roll of private sector insurers in the market. Considering all these, the scope of the sector is exponential, the growth expectancy is huge and the market players are well-tuned. The landmark initiatives of government would even boost the morale

resulting in more capital formation, more employment generation and a better human development ranking.

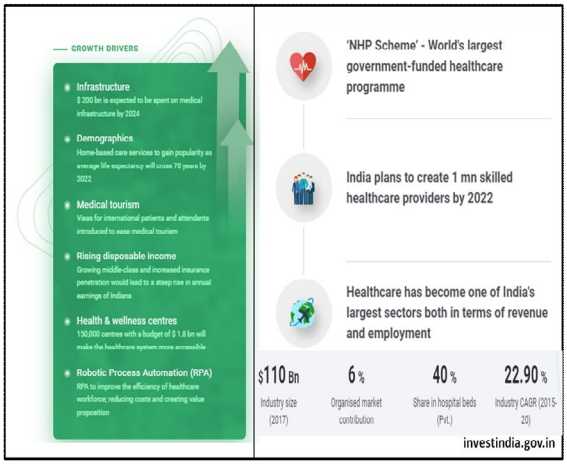

Figure 5

REFERENCES

[1] Cadilhac, D.A., Magnus, A., Sheppard, L., Cumming, T.B., Pearce, D.C. and Carter, R. 2011, 'The societal benefits of reducing six behavioural risk factors: An economic modelling study from Australia', BMC Public Health, vol. 11, no. 483, pp. 1–12.

[2] Charlesworth, A., Davies, A. and Dixon, J. 2012, Reforming Payment for Health Care in Europe to Achieve Better Value, Nuffield Trust, London.

[3] Gallego, G., Haas, M., Hall, J. and Viney, R. 2010, Reducing the Use of Ineffective Health Care Interventions: A Rapid Review, Sax Institute, Sydney.

[4] Larsson, S., Lawyer, P., Garellick, G., Lindahl, B. and Lundstrom, M. 2012, 'Use of 13 disease registries in 5 countries demonstrates the potential to use outcome data to improve health care's value', Health Affairs, vol. 31, no. 1, pp. 220–227.

[5] OECD (Organisation for Economic Co-operation and Development) 2013, Health at a Glance 2013, Paris.

[6] Das Gupta, M. (2005). "Public Health in India: An Overview," The World Bank Policy Research Working Paper WPS3787.

[7] Cropper, M.L. (1977). "Health, investment in health, and occupational choice", Journal of Political Economy, 85, 1273-1294.

[8] Grossman, M. (1972). "On the concept of health capital and the demand for health," Journal of Political Economy, 80 (2), 223-255.

[9] Rao, Sujatha K.; Selvaraju, S.; Nagpal, Somil; and Sakthivel, S. (2005). Financing of Health in India. Financing and Delivery of Health Care Services in India. New Delhi: National Commission on Macroeconomics and Health, Ministry of Health & Family Welfare, Government of India. August.

[10] Choudhury, Mita. (2006). Public Spending on Health in Low-Income States and Central Transfers. Financing Human Development Policy Brief (No. 1, September, 2006). Retreived December 5, 2008, from National Institute of Public Finance and Policy Web site: http://www.nipfp.org.in/tapasreport/Policy%20Brief-1.pdf

[11] Sehgal, S. and S. Hooda (2015): "Emerging Role of Private Sector in Indian Health Care Delivery Market: Trends, Pattern and Implications," Intern report, Institute for Studies in Industrial Development (ISID), New Delhi