

LOOKING INTO THE RELATIONSHIP BETWEEN INFRASTRUCTURE CONSUMPTION AND ITS FINANCE

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Abstract--- Infrastructure provided through different channels to improve people standard of living, can be thought of as an important ingredient of peoples' consumption basket and naturally, the cost incurred in provision of basic amenities, benefits and advantages, by varied nature of infrastructure should bear a close correlation to people choice and their ability to earn, spend and contribute. From this perspective, method sought for financing of infrastructure must take into account the extraction process to explore category of people, coming under the ambit of specific infrastructure supply and sources should be in accordance with the degree to which it entangles the population circle of an economy, if streams of special incentives are appropriated by certain schemes and sections, whether forward or backward, mechanism must have base in setting criterion, space and parameter for adjustment and thus, determine its quantity and quality of finance.

This paper analyses category of infrastructure consumption and its inclusion in determining financing pattern with special reference to India and the empirical part is based on simple statistical percentage and regression analysis. (Abstract)

Purpose – The paper aims to study the category of infrastructure and its nature of finance.

Approach - To analyse the relationship between infrastructure consumption and methods of finance.

Findings – Simple statistical steps support the base of thought.

Practical Implications – The result is helpful in determining logical base for infrastructure finance.

incurred expenses would need to be more.

There are also certain types of infrastructure, which is sought to bring primary benefit and secondary benefit or direct and indirect centrifugality. For primary or direct outcome, recipient receive through the direct supply of a typical infrastructure while for the second category, these come to the other section of people, mainly through the spill-over effects of the externalities. This type of thought can also be taken into account in having guidance towards the burden sharing of infrastructure provision. Sub-circles of the aggregate circle for which the infrastructure is provided, can also be consisting of two different classes of people with higher purchasing power and lower purchasing power.

Sharing of incurred expenses, in such case, can consider one criterion of number of times, a particular infrastructure is utilised by those sub-stratum of population. From this perspective, it becomes very important to think about the side making the demand for consumption of infrastructure services in order to take decision about the nature of finance for that as the consumer set can give direction about the

Research Limitations – This effort is based on a particular type of infrastructure may be generalised.

Originality – This will be a meaningful addition.

Keywords - Infrastructure Consumption, Financing Pattern.

JEL Classification – H54. E21. G20

I. INTRODUCTION

Infrastructure demand differs from the normal conception of demand in a way that macro-aspect is the prime requirement of consideration. On the other hand, supply of infrastructure, generally remains associated with the outpourings of externalities [1]. However, both these considerations have a novel basis to realise its practical implementation – desired and made possible for the concerned aggregate mass, i.e., for all. Nature of infrastructure can be classified on the platform explaining this aggregate. As the circle of aggregate becomes shorter and shorter, smaller interest comes into prominence and private justification is sought for infrastructure provision. When for a particular type of infrastructure, this aggregate circle gets composed of other sub-circles of small and large masses, i.e., different category of people, then financing of infrastructure can be generated by them, in proportion to their benefit appropriation. If, streams of shower flow at a greater rate to a particular section of people than other sections for supplying a specified type of infrastructure, then sharing of responsibilities in contributing towards the

proper search criterion in determining the burden sharing set, surely inclusive of the governmental responsibility.

A. INSTANCES OF TRANSPORTATION AND WATER INFRASTRUCTURE –

- When a passenger road is built up, primary or direct benefit is appropriated by the persons lining the road while for others, it becomes secondary or indirect benefit as they derive only the facilities and opportunities of being high-road side.
- Similarly, for the freight corridor provision, primary consumer turns out to be the industries along that highway whereas the interior industries appropriate the secondary or indirect benefits in the form of second-round of raw material accessibility.
- For water supply infrastructure, families nearer to the source, become the primary consumers, leaving the same source as a distant or secondary consideration for the others. Then, drinkers nearer ought to bear more than those ones too far. Another thought emerges as crucial into the criterion,

keeping space for the affordability of the consumers and this leads to the consideration that for people who cannot afford, government needs to subsidise or the source can be set at that point.

- Similarly, for the industries along road or high-road, this public utility characteristic should be taken into account in fixing the criterion to raise the proportional share of expenditure incurred into the infrastructure provision.
- Infrastructure constructed to serve a populated area, can pick up the required finance from the inhabitants whereas any other initiative undertaken in the vicinity of that locality, gets the access to that infrastructure comfortably at proportionately lower cost of production. But when infrastructure are built to meet specific demand of a particular initiative, then it becomes mandatory for the new venture to bear the incurred expenses at a greater share rate of burden, which effect can diffuse to other areas – near or far distant locality as externalities and this should impose comparatively lower expense finance share on them. For creating specific economic zones, this becomes imperative for the participants to move in this way while the externalities flowing for others, should motivate their responsibility to share the cost of production at a rate as minimum and as suitable as possible.
- In case of port, infrastructure construction and maintenance has national and international interest as a particular nation takes part inter and intra-water trade and transportation, thereby making it a national responsibility to sustain the viability of the port sector in order to participate both in the external trade and trade & transport through water network. Additional utilisation of the existing port infrastructure, positively correlated with the national welfare, necessitates for the traders and transporters to contribute greater share of expenses to the national exchequer as well as permission may be granted to the applicants for building and running additional commensurable port infrastructure on their own to facilitate the smooth functioning of the existing port network under the license [2] to do so.

II TELECOMMUNICATION SECTOR

Presently, the telecommunication infrastructure is evolving as the most prominent widespread instrument of advanced scientific technological evolution for smother and faster transaction, not only within the nation but also with the other countries of the world. Everyone is getting connected to this specific infrastructure in some way or other – a type of technological revolution in communication and exchange, one can say, found to take place after the Industrial Revolution of the 17th – 18th century. If minutely watched under the analytic telescope, it can be observed and confirmly stated that the rate of diffusion of this technological revolution is very much faster than that of the earlier any revolution or invention or innovation. Silicon based technology and its upgradation is gradually replacing the huge paper load and shrinking the required larger space and the related bamboo cultivation is becoming obsolete profession of the past. Even the wireless radiation based

scientific advancement is reducing the importance of copper mining – succinctly, relative significance of metals, mines and overall, livelihood pattern is undergoing a faster noticeable change. However, like these adversities, this fact cannot be denied that consumers of this infrastructure, in present age, are all and hence, the share in cost of production is ought to be low, if the concerned national authority takes initiative to provide for the reflecting towers on large scale to appropriate the economies of large scale production whereas responsibilities entrusted on the other hands, if not allowed under national and international authority and supervision as well as global welfare, may find interest in undermining or the diminished public utility characteristics. Diminished average cost of production flowing from technological upgradation through research and development activities, allows with time, other sectors or companies to participate in this newly emerging infrastructure industry – what is required a healthy cohesion of all the sectors to serve the national and global interest – ultimately, technological infrastructure or any other infrastructure – it is created for the welfare of the people of this globe. From this perspective, suppliers of this infrastructure industry gets a new arena for the mass scale production based on silicon with the associated large scale economies of scale, thereby making the average cost of production further lower – both statistically and dynamically and thus, can provide this particular service to the consumers at very low burden share [3].

III ENERGY SECTOR

In case of power generation or energy creation – electricity tends to be consumed by all in moving household appliances, daily activities, agricultural instruments and factories. Similar rate of charges with some differences are fixed for the different category of users of electricity, although its generation or supply comes from the different sources, i.e., coal, water, air, solar power and presently, nuclear power. Thermal power generation needs the presence of coal as fuel or radioactive elements as fuel, which is to meet the environmental standards as well. Otherwise, low-price electricity generation is made possible through hydroelectricity, solar panel and recently, aerodynamics – particularly in the wind prone areas and hilly areas. Except some landlocked countries, water, solar cell and air are utilised to generate electricity, which are not in the case of thermal power grids as coal mining or supply of radioactive elements are not available or sufficiently abundant everywhere. These different sources manufacture electricity at different rates although uniform class rate is fixed for the varied classes of the consumers with differentiation. Here, the regulation criterion through affordability legitimately can enable the national authority, on the basis of some standard measuring the capacity to pay like that of poverty line classifying people, i.e., infrastructure consumers into BPL and APL – below poverty line & above poverty line, to perform its duties towards serving the national welfare interest by fixing relatively higher rate for the well-to-do section of population and thereby, in subsidising the provision of electricity for others, who cannot afford the cost of service [4].

IV EMPIRICAL FINDINGS

For empirical guidance to analyse the pattern of infrastructure finance and its relation to the infrastructure consumption, transport sector in India, particularly Indian Railways are taken into account. Expenditure of Indian Railways, its route length and Indian population census data are considered for the period 1961-2011. One time series namely, expenditure per route length of Indian Railways is prepared for the above mentioned time-period and denoted as EPRL.

Figure 1 shows that the EPRL time-series is non-stationary.

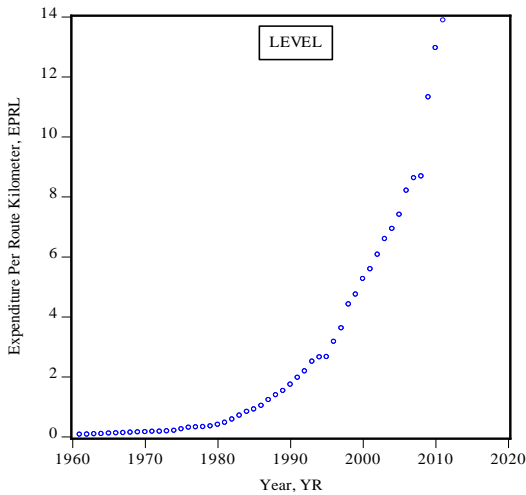


Fig 1: Scatter diagram of EPRL time-series - level

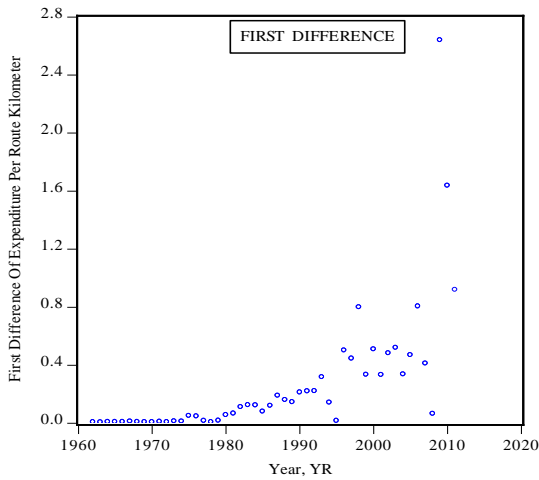


Fig 2: Scatter diagram of first difference of EPRL time-series

When, expenditure per route length of Indian Railways is regressed upon the interval 1961-2011 to find the changes in expenses incurred on constructing one kilometer of route length, the basic equation is derived as follows:

$$EPRL = \alpha + \beta * YR \tag{1}$$

Where,

- EPRL ----- Expenditure Per Route Kilometer
- YR ----- Year
- α ----- Effect Of Changes Other Than Year
- β ----- Effect Of Changes With Year

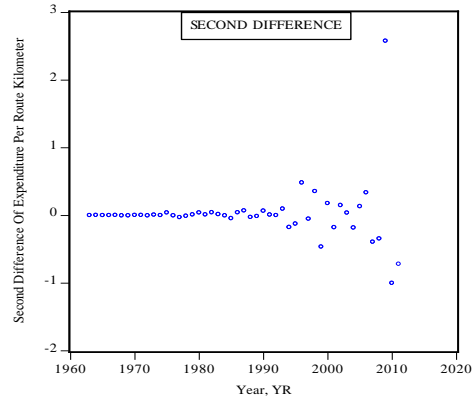


Fig 3: Scatter diagram of second difference of EPRL time-series

As non-stationarity property of time-series can lead to spurious result and unstable relationship, basic eqn. (1) needs to be modified after converting the non-stationary time-series into stationary form.

Scatter diagram of Fig. 2 and Fig. 3 make it evident that first difference of the EPRL time-series is more closer to the property of stationarity than that of its second difference. Then, first difference of expenditure per route length of Indian Railways is regressed upon the interval 1961-2011 to find the changes in expenses incurred on constructing one kilometer of route length with time and the estimated equation takes the following form,

$$\Delta EPRL = \alpha_1 + \beta_1 * YR \tag{2}$$

Where,

$\Delta EPRL$ ----- First Difference In Expenditure Per Route Kilometer.

α_1 ----- Effect Of Changes Other Than Year on $\Delta EPRL$

β_1 ----- Effect Of Changes $\Delta EPRL$ With Year

TABLE I: EVIEWS ESTIMATION

<i>Dependent Variable: D(EPRL,1)</i>				
<i>Method: Least Squares</i>				
<i>Date: 04/15 14 Time: 10:56</i>				
<i>Sample (adjusted): 1962-2011</i>				
<i>Included observation : 50 after adjustments</i>				
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
C(1)	-40.18	6.90	-5.83	0.00
C(2)	0.02	0.004	5.87	0.00
R-squared	0.42	Mean dep. Var		0.28
Adjusted R-squared	0.41	S.D. dep. Var		0.46
S.E. of regression	0.35	Akaike info criterion		0.80
Sum squared residual	6.03	Schwarz criterion		0.88
Log likelihood	-18.05	Durbin-Watson stat		1.55

After making the time-series stationary, regression through Eviews shows the result given in the above TABLE I:

This empirical calculation can be expressed through the following equation number (3),

$$\Delta EPRL = 40.18 + 0.02 * YR \quad (3)$$

The fitted values of expenses incurred on constructing one kilometer railways in the different population census year, derived from eqn. (3) are tabulated in the above TABLE II.

TABLE II: FINANCIAL CHANGES

Year	Exp/Km (Rs. Lakhs)	Population (Lakhs)	Exp/Km/Head (Rs. Lakhs)	Changes
1961	0.75	4392.3	0.0002	
1971	1.71	5481.6	0.0003	1.82
1981	4.74	6833.3	0.0007	2.22
1991	19.69	8463	0.002	3.36
2001	55.92	10286.1	0.005	2.34
2011	138.81	12105.7	0.011	2.11

SOURCE: CSO [5] & POPULATION CENSUS OF INDIA [6].

From the above table, it can be observed that both the expenses per route kilometer and expenses per route kilometer per head increased in the successive population census years but the changes between the consecutive years after increasing upto the decade of 1981-1991, slowed down and made a decreasing trend. The multiple times by which the burden of expenses incurred on laying down one kilometer railway line, felt by every Indian, increased by 1.82 times between 1971-1961 and the increasing trend led it to be enhanced by 3.35 times between 1981-1991 whereas after 1991, estimation shows that even though the aggregate expense per route kilometer per head increased, rate of increase became slowed down from 3.35 times between 1981-1991 to 2.34 times between 1991-2001 and then, to 2.11 times between 2001-2011. This implies the potential economies of bigger public effort made through railways construction of the earlier period were started to be realised by the Indian economy from the mid-1980s resulting from high gestation period and this provided the requirement of the initial infrastructural facilities [7] for the new initiatives to venture and in India, private and joint sector during this period onwards, encouraged by the globalisation, liberalization and privatisation policy, obtained a favourable place and became more able to reap the benefits of those economies of scale of large scale infrastructure construction like railways with the receding role and cropped up inefficiency of the public sector.

V. CONCLUSION

One aspect should be considered in discussing the relationship between infrastructure consumption and its finance related to the cost of providing service – producers want to minimise while the consumers want it at the level of minimum affordability. Then, the material went into the construction of a particular infrastructure, should be in consonance with the resource base of an economy. This will make the availability of the infrastructure services cheaper by lowering the cost of production for the producers. For the

nations having the required resources, this automatically enters into the criterion under the proper surveillance while for the other nations, emphasis needs to be placed on the building of infrastructure facility serving the external trade sector, that may be one reason substantiating one historical fact behind the regional advancement or one step forward of the port oriented or external trade prone areas or nations. Presently, what the big giants, i.e., the multinational companies (MNCs) are found to follow in their operation, making the international exchange by basing their plants in other nations by their stronger external trade sector and getting access to the much needed resources. This is leading to the outsourcing of activities also, thus making the global average cost of production lowered on one hand – on the other hand, based on one line of thought, nations perceive this incidence and also argue as the interference coming to the national sovereignty, which may originate from the sole profit motive related to the flight of international capital and associated spread of neo-imperialism, i.e., historical old wine in a new bottle. Thus, the relationship between infrastructure consumption and sharing the burden of its finance depends on the nature of the specific infrastructure concerned as well as that of its consumers and taking these factors into account and including the people welfare motive alongwith the sustainable profit motive into the production criterion of this democratic globe, we get the impression that further improvement can be brought in the matter of infrastructure financing pattern as well as that in its consumption rainbow.

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