

Indian Ports and Globalisation

Grounding Economics in Geography

This paper is concerned with the economics of Indian ports as one important phenomenon in Indian economic geography, and its relationship with regional development under the free market economy. A port performance index derived with the help of principal component analysis of eight individual port performance indicators shows that overseas traffic intensity is the most significant determinant of performance. With increasing openness of the economy and absence of an integrated policy toward export transport network, there is a decline in export intensity and rising domestic coastal traffic in Indian ports.

BUDDHADEB GHOSH, PRABIR DE

There is a kinship between economics and geography. It is easy to understand but difficult to prove empirically. Even though it is transparent, until very recently it was not acknowledged in Indian academic circles. But this was recognised by both classical economists like Adam Smith, and the pioneers of development economics like Myrdal and Hirschman. Smith's emphasis on geography relates to the transport mechanism which strengthens his classic sequence of specialisation → division of labour → productivity → extent of market:

As, by means of water-carriage a more extensive market is opened to every sort of industry than what land-carriage alone can afford it, so it is upon sea-coast, and along the banks of navigable rivers, that industry of every kind naturally begins to subdivide and improve itself, and it is frequently not till a long time after that those improvements extend themselves to the inland part of the country.

At another point Smith's reference to India (and Bengal) reminds us of our past trading glory:

There are in Africa none of those great inlets, such as the Baltic and Adriatic seas in Europe, the Mediterranean and Euxine seas in both Europe and Asia, and the gulfs of Arabia, Persia, India and Bengal, and Siam, in Asia, to carry maritime commerce into the interior parts of that great continent...

But up to the eighties economists did not deal directly with such factors as transportation and ports, manufacturing belt and urbanisation which exemplified 'increasing returns'. Thus, until recently, the relationship was rather asymmetric. For example, economic geographers abroad, while constructing their analytical theories and explanations of unbalanced regional

development, have drawn freely on the prevailing concepts of economics. But economists have tended to accord little if any attention to geographical factors in economic modelling even when they fail to find any economic explanations for the same. The traditional logic that counters this argument points to the price mechanism that is supposed to take care of the forces of supply and demand. But it fails to answer the problems of specialisation, trade orientation, increasing returns and hence regional inequality.

Traditional trade economists have been regarding the national economy as 'spaceless' [Krugman 1998]. 'Space', or what may be called 'geography', is so important that it can neatly divide the world into some basic building blocks. For example, there are on the whole 35 land-locked counties in the world which, except a few European countries like Austria and Switzerland, are neither developed nor rich in terms of per capita income. These handful of countries (seven only) are located in western Europe, and hence deeply integrated into the developed European space. This is perhaps one of the causes for the commonly held view that poverty is by and large 'tropical' [Gallup and Sachs 1998].

Moreover, a significant share of the population in the developed countries is concentrated in the coastal region. By sharp contrast, the population in south Asia is heavily concentrated in the interior. Specifically, India's great mass of population lives along the course of the Ganges. Most of these habitations are often hundreds of kilometres away from the coast. Among others, this demonstrates our inward-looking attitude. For example, even in those states that have a very high coastal line, the main centres of economic activity are

located in the hinterland. A highly plausible area of future research would be to find whether our failure to exploit the huge coastal line is the result of our inward-looking economic policies pursued over the last 50 years.

It is worthwhile to mention here that nearly 200 years after Johann von Thunen's *Isolated State* (1826), 70 years after Alfred Weber's *Theory of Location of Industries* (1929), 50 years after August Losch's *The Economics of Location* (1954) and Walter Isward's *Location and the Space Economy* (1956) were published, nowhere in the world do spatial factors like transportation (and more specifically, port), regional inequality and urbanisation have found any place in economics textbooks.

Before switching to the theme of the paper let us have a brief recapitulation of the logic behind the rise of this 'new economic geography'.¹ In the standard neo-classical formulation, there is a natural smooth tendency towards inter-regional transmission of growth from the richer to the poorer regions within an economy with perfect mobility of factors and diminishing returns to capital. Barro and Sala-i-Martin (1995), Quah (1993) and many others have tried to test the hypothesis of convergence of economic growth or levels of economic development between different regions within a country and also between different advanced countries themselves. But this theorisation pays little attention to the spatial variables which, for all practical purposes, have significant influence on the process of economic development. Moreover, Indian economic development during the last 50 years displays rather a tendency towards divergence across the major regions [Marjit and Mitra 1996; Ghosh et al 1998].

A parallel literature in economic geography has been simultaneously trying to enrich the explanatory power of the regional development theory incorporating the impact of external sector on domestic economic development more specifically. Thus over the past two decades a 'new trade theory' and a 'new economics of competitive advantage' have emerged which have brought to the forefront the role that the internal geographical factors of a nation may play in determining the trading performance of that nation's industries as well as concentration / spread of economic activity.² In this endeavour, Paul Krugman, the leading exponent of the 'new trade theory' has sought to answer how international trade of a country is both influenced by and in turn influences the process of geographical distribution of economic activities within a nation [Krugman 1991 1993, 1995]. In a different but related vein, Porter (1990) has argued that the degree of geographical clustering of industries within an economy plays an important role in determining which of its sectors command a 'competitive advantage' in the global economy.

Thus in order to understand the trading performance of a country we need to know the nature of supply of the trading instruments of the regions of the country from the points of production to the final outlet in the chain of transportation. This may be reflected in differing economic performance of various competing regions. Thus the linkage from the production points to the shipment points through various transaction points in the chain of location is a central theme of the process by which national economic prosperity and trade are created and maintained.

Thus one of the most important justifiable forms of industrial (and trade) policies that regional, industrial and locational factors merit is neglected in most of the LDCs and of course in India.

Against such a background the purpose of this study is to highlight the role the port plays in India's regional economic development, and also to find relationship between port performance and overseas traffic. The importance of such work has increased since the initiation of the globalisation programme in 1991. But no serious attempt has been made to this effect except the *India Infrastructure Report* [GoI 1996]. Above all, one objective of this paper is to invite discussion on various aspects of the topic dealt with here.

The organisation of the paper is as

follows. Section I deals with the concept of port and studies relating to regional growth. Section II deals with data and methodology and gives a schematic classification of Indian ports and their institutional framework. Inequality among Indian ports and ports of maritime states are discussed in Section III. Also discussed are individual performances of Indian ports along with the construction of a port performance index (PPI). Section IV analyses the relationship between port performance, cargo composition and per capita income, in terms of the degree of openness, port traffic and port capacity. Section V concludes with an analysis of policy issues including the pros and cons of privatisation initiatives, and future research.

I Ports in Theory

A port is essentially an economic concept, an economic infrastructure that serves coastal and overseas traffic. Port is a subsystem of the total transport network and a meeting place of other modes of transport. A port is a gateway for the entrance from surface water to land and vice versa. Port is also construed as the major crossroad of traffic in ideas, peoples and goods over the centuries [Kindleberger 1996]. There is sufficient evidence in literature of a strong spatial relationship between transportation and economic development. It is universally recognised that capital formation has very direct and positive impact on growth. Transportation is an important component of capital formation. The question of where economic activities should be located is partly determined by 'historical accidents' and partly by the geographical specificities of the country concerned—the motive force which guides economists to develop models of the spatial structure of the economy. Krugman (1998) has also emphasised spatial perspective as evident in the ways in which geographic phenomena are spatially interconnected and the interaction that occurs over geographic space.

In recent works Fujita and Mori (1995a, 1995b, 1996) have explained the evolutionary model of spatial economic development in which agglomeration economies and the hub-effect of transport nodes interplay in the making of major cities. Their model explains the irreversibility of spatial economic development such as the continuing prosperity of port cities even after initial advantage of water-access

became irrelevant. It is also shown that in order to decentralise industries from the core region to a periphery, a temporary protection of industries in the periphery by worsening the transport connection with the core for a short period of time may be desirable. But their findings may not be true in case of an economy where port does not play a decisive role in the growth of the economy.³

The historic and most common view about the role of transportation in the development process is as a precondition or prerequisite for economic growth. While dealing with the stimulus to the take-off stage of economic growth in the US, Rostow (1964) identifies the railroads as the critical investment sector. According to Hunter (1965), the economic history of western Europe and North America has shown that the introduction of modern transportation methods has drastically lowered shipping costs. There is a causal linkage between low-cost transportation and economic development. The industrial revolution was facilitated, among other things, by a prior revolution in transport technology. Some pioneering studies [Fogel 1964; Cootner 1963] have found that in terms of causal association, development of transportation facilities was the outcome of rising demand. That is, transport facilities were built-up in a process of 'backward linkage' of industrialisation. Hardly any attempt has been made in recent years to verify the impact of transport network on trade in the LDCs. To the best of our knowledge, the work by Taaffe et al (1963) is such an attempt for understanding the transport network and development in west Africa.

Samuelson (1954) in a classic paper dealt with the effects of trade impediments as a result of transport bottleneck under a 2x2 framework. But considering the exact location of production unit of the exportable item in the home country thereby making 'distance' an explicit issue, things become much more complicated as pointed out by Rauch (1991). Accordingly to him, per-unit-distance transportation costs within the country always account for the final node of volume of trade than the same exportable items of other countries. These costs combined with the assumption that cities are the basic units of spatial organisation in a country lead the model to predict that population size, wage rates, and residential rental rates of cities will all decline monotonically as one moves inland from a coastal port. But this result is

an exception rather than a rule in the present Indian situation of human settlement and concentration of industries.⁴

There is also a belief that transport is a safe investment politically. Hirschman (1958) suggests that perhaps it is the absence of criteria and of sanctions that endears transportation investments so much to developers. After all, development planning is a risky business, and there is naturally an attraction to undertake ventures that cannot be proven wrong before they are started and unlikely ever to become obvious failures.⁵

We have so far seen that some studies have addressed the role of transport in regional development but very few of them have assessed the significance of ports therein. There is also no dearth of studies that have focused on regional disparity in India in general during the last few decades, but not a single study has taken port facility as an infrastructure attribute to assess either regional disparity or trade impediment in India.⁶

A port grows by virtue of the trade it can attract. Its growth is a function not only of technologically related supply facilities but also of the economic and political objectives of a country that determine the demand for port services. The history of port development is often an epitome of changing economic, political and technological circumstances on various scales aided by outward orientation of the economy [Ray 1993; Kindleberger 1996].

An efficient port raises the productivity of other factors of production (labour and capital) and profitability of the producing units thereby permitting higher levels of output, income and/or employment. For most of the underdeveloped world, the role of port as a policy instrument for both higher mobility and lower transaction cost as well as for spreading the growth centres away from the core metropolitan location has not been utilised so far.

During the last two decades increased globalisation and intensified competition in world trade have resulted not only from the liberalisation of trade policies but also from significant advances in transport, communication, storage and power facilities. These developments have transformed the traditional organisation of production and marketing in order to gain competitive advantage in the international market. The main focus here is on management and transport logistics to achieve efficient utilisation of inputs thereby permitting rapid response to emerging facilities.

In India, some worthy but unheeded works have started to come out which deal explicitly with non-price factors as the most important barriers to India's success in foreign trade [Peters 1990; Marjit and Roychoudhury 1993; EXIM Bank 1998]. Thus, the ability of the developing countries to provide the required transport and communication services essential for modern logistics management will increasingly determine their ability to compete for export market and direct foreign investments. Mexico's maquiladora operations, Chile's exports of fruits, Columbia's of cut flowers and Kenya's of horticultural products are examples where countries have been able to meet logistic requirements of their overseas customers. On the other hand, there are many examples of countries which are losing the competitive edge because of shortcomings both in key infrastructure as well as in institutional and procedural delays, especially relating to custom processing and transport services. In India, the freight rate of container traffic and transit times through ports exceed those of her Asian competitors by large margins. This seriously constrains India's export promotion goals. Therefore, the success of economic reform, which is essentially a sort of export-led growth strategy, crucially hinges on the level, development and utilisation of transport and communication facilities, especially ports.

II Ports in Practice

For the present purpose, we have organised data for nine Indian states over the period from 1970 to 1996.

In India, income data are very scarce. Net state domestic product (NSDP) as given by the government are defined as the net value added (after depreciation is accounted for) originating in each state. Here we have gone a step further from the prevalent practices for the conversion of nominal NSDP into real term. Following Ghosh et al (1998) which to the best of our knowledge is the first paper in this line, we have used consumer price indices for agricultural labourers (CPIAL) with base 1960-61=100 for deflating nominal PCNSDP.⁷

Another major achievement of this paper is port facility. This in the Indian context can be understood as public infrastructure input from the supply side. We have taken eight important variables for major ports for four different time points over the period from 1985 to 1996 to judge their relative

performance. These include (i) ship turnaround time, (ii) pre-berthing waiting time, (iii) percentage of idle time at berth to time at working berth, (iv) output per ship berth day, (v) berth throughput rate, (vi) berth occupancy rate, (vii) operating surplus per ton of cargo handled, and (viii) rate of return on turnover (Appendix 1).

These data are taken from the following sources: (i) estimates of state domestic products, (ii) *Economic Survey*, (iii) Statistical Abstract, (iv) National Accounts Statistics, (v) Basic Ports Statistics of India, and (vi) Transport Statistics of India – all published by the government of India. This data set is supplemented by various publications of (i) the Centre for Monitoring Indian Economy (CMIE), Mumbai; (ii) India Database – The Economy (Vols I and II) by H L Chandok and The Policy Group, and various publications of Indian Ports Association, New Delhi .

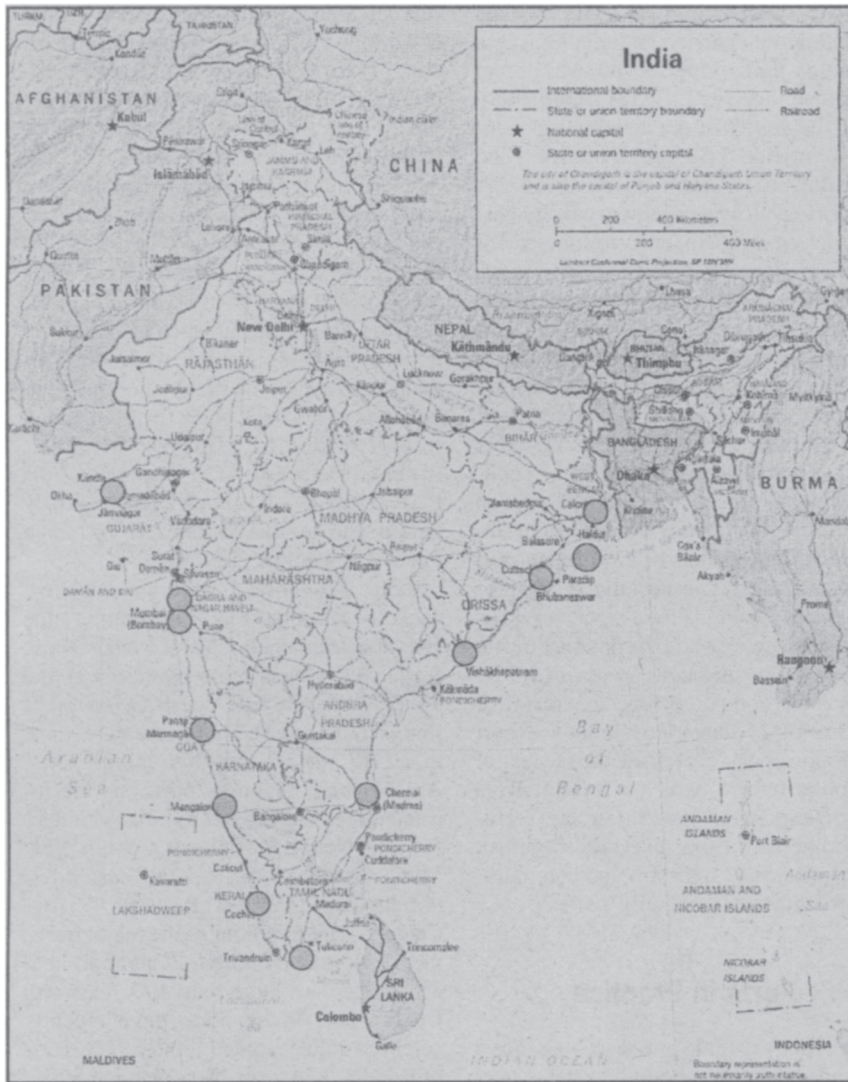
India is endowed with an extensive coastline of about 6,000 kms along nine coastal states, namely Gujarat, Maharashtra, Karnataka, Goa, Kerala (west coast) and Tamil Nadu, Andhra Pradesh, Orissa, West Bengal (east coast). These nine states have in all 12 major⁸ and 179 minor ports. Among these 12 major ports, six are located on the west coast (Kandla, Mumbai, Jawarlal Nehru, Mormugao, Cochin, New Mangalore) and six on the east coast (Chennai, Tuticorin, Paradip, Vizag, Calcutta, Haldia). Four of the major ports, viz, Calcutta, Mumbai, Chennai, and Mormugao are more than 100 years old. Cochin and Vizag ports have recently celebrated their golden jubilee. The ports of Kandla, Tuticorin, New Mangalore and Paradip came into existence after independence. JNPT became operational after 1989.

Out of total declared 179 minor ports including 13 non-working ports, 120 ports (67 per cent) belong to west coast states, 24 ports to east coast states and the rest (35) belong to the island union territories. Maharashtra is the only state having the highest numbers of both major (2) and

Table 1: Annual Throughput of Selected Ports of the World in 1994-95

Port	Traffic (in MT)
Rotterdam	288
Singapore	274
Shanghai	165
Houston	126
Hong Kong	102
Antwerp	102
Tokyo	79
Hamburg	65
Mumbai	32
India (all major ports)	197

Figure 1: Maritime States and Major Ports in India



minor (53) ports in India. Next is Gujarat where one major and 40 minor ports are situated. West Bengal is the only maritime state which, even with adequate waterfront has no declared minor port.

India's total port cargo has increased approximately fourfold between 1970-71 and 1995-96 rising from 56.14 MT to 218.07 MT. It may appear to be a high rate of growth but in any international comparison, our port-intensity is representative of our trivial trade orientation. As evident from Table 1, while all the major ports of India handled traffic of 197 MT in 1994-95, Rotterdam alone carried 288 MT, Singapore alone 274 MT and Shanghai alone 165 MT. As a matter of fact, during the same period, Mumbai port handled the highest cargo of 32 MT

in India which was insignificant compared to other global ports. A comparison of India's port traffic and openness with those of China makes it clear why China won the first round of liberalisation. In

1996-97 China's openness ratio of 43 per cent was just double that of India but China's port traffic was five times that of India.

The natural advantage of having a long coastline in the economic life of a region even within a country is evident from Tables 2a and 2b. First, with a perceptibly lower geographical area (42.25 per cent as against 57.75 per cent for rest of India which includes both Madhya Pradesh and Uttar Pradesh), the shares of the coastal states in total population and GDP in 1996-97 were as high as 49.34 per cent and 61.71 per cent respectively (See Figure 1 for the map of maritime states). In terms of population density, urbanisation and literacy, the coastal states stand much higher than the rest of India. Naturally therefore, the average real per capita income of the non-coastal states (Rs 614.08) is not only lower than the average of the coastal states (Rs 818.78) but also lower than the all-India average of Rs 684.94. Another notable feature is that the share of the coastal states in GDP has been rising continuously since 1960-61 from 57.02 per cent in 1960-61 to 59.10 per cent in 1990-91. This disparity is strengthened in the post-reform period: 2.61 per cent increase in this share has occurred only within a span of six years. Only Delhi (Rs 1,348.96), Punjab (Rs 1,118.36), Haryana (Rs 995.35) have per capita incomes higher than the coastal states. Finally, investment in EOUs in the coastal states during the post-reform period has risen as high as 74 per cent. Better

Table 2 (b): Share of Coastal States in India's Gross Domestic Product (GDP)

Year	Share in GDP (Per Cent)
1960-61	57.02
1970-71	57.17
1980-81	59.12
1990-91	59.10
1996-97	61.71

Table 2(a): A Comparison between Coastal and Non-Coastal States: 1996-97

Features	Coastal States	Rest of India
Area (000 sq.km)*	1388.70 (42.25)	1898.30 (57.75)
Population (000)*	417598 (49.34)	428705 (50.66)
Population density (per sq km)	301	226
Urban population (per cent)	30	24
Literacy rate (per cent)	62.34	55.07
Share in GDP (per cent)	61.71	38.29
PCNSDP (Rs)**	818.78	614.08
Share in investments made in		
100 per cent EOUs (August 1991-September 1998) (per cent)***	73.71	26.21
Share in manufacturing value added (per cent)	68.05	31.95
No of inland container depots (ICDs)	10	4

Notes: * Numbers in parentheses are the percentage shares of the respective features.
 ** Deflated by CPIAL (1960-61=100).
 *** Total investment in this period was Rs 62,930 crore.

Figure 2: Lorenz Curve for Port System of Major Ports

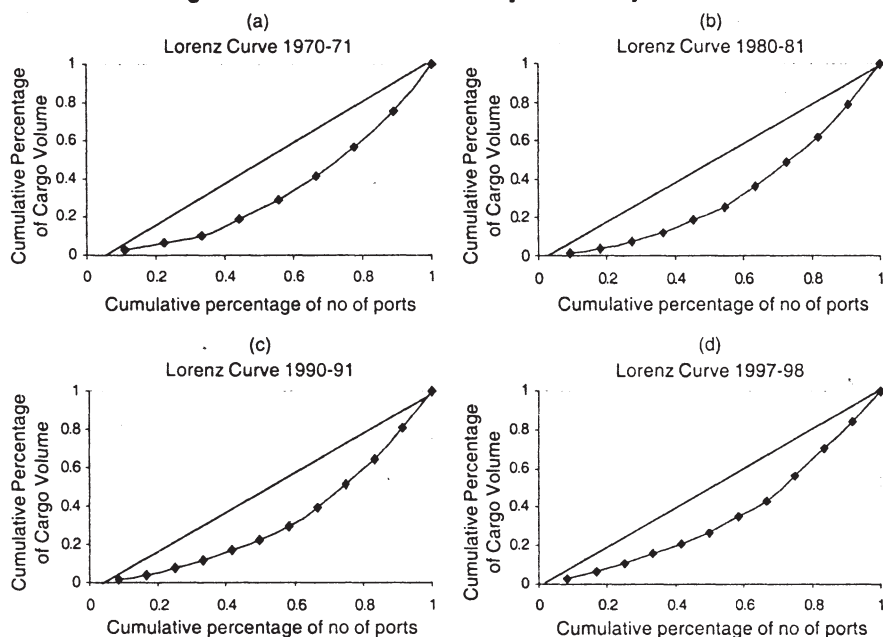
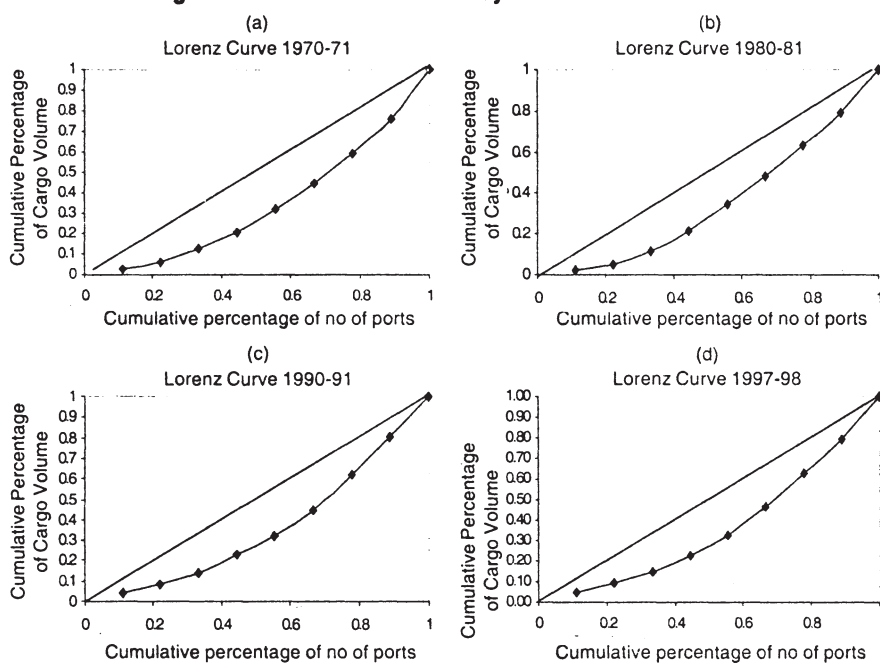


Figure 3: Lorenz Curve for Port System of Coastal States



endowment of the coastal states is also evident from the corresponding shares of industrial value added.

The foregoing analysis only reminds us of the fact that there must be some economic advantage to having ports.

Ports in India are classified as 'major ports' and 'other (minor) ports'. Major ports are under the central government's control and these, by entry 27 in List I of Schedule VII to the Constitution of India, are a central subject. They are governed

by the Major Port Trusts Act of 1963 and the Indian Ports Act of 1908. Ports other than major ports are included in List III (concurrent list, entry 31), and are controlled and operated by state governments subject to some central legislation. The primary responsibility for the development and management of minor and intermediate ports rests with the state governments within the purview of Indian Ports Act, 1908.⁹

The Indian Ports Act, 1908 mainly describes the regulatory powers of the Port

Authority whereas the Major Port Trusts Act, 1963 enables the port to conduct its regulatory as well as commercial functions. Indian Ports Act, 1908 extends automatically to all ports and parts of navigable rivers and channels leading to the ports irrespective of category (ie, major and minor). Major Port Trusts Act, 1963 is restricted to the port proper of the major ports.

'Major ports' mean any ports which the central government may by notification in the central gazette declare under the Indian Ports Act, 1908, or may under any law for the time being in force have declared to be a major port. (Ports of Calcutta, Mumbai and Chennai were declared 'major port' in pursuance of statutory enactment dated December 16, 1920, and were brought under the direct control of the central government by virtue of the Seventh Schedule of the Government of India Act, 1935.) 'Other port' means any port, which the state government may by notification in state gazette, declare as a port.

The crux of the matter is that ownership, control and administration of minor ports differ from state to state. While some maritime states have enacted maritime board acts and created maritime boards for management and control of their ports, other states still continue to perform these functions under their ports and fisheries departments. The states, while promulgating order for laying down their rules of business, also allocate the subject for the control of various departments through these orders. Even where the states have enacted a maritime board act and created a maritime board, the administration and supervision of the maritime board is vested in the ports and fisheries department as the case may be. However, most of the maritime states are in the process of reorganising the control structure for their ports by constituting maritime boards. Gujarat and Maharashtra have already created maritime boards whereas Andhra Pradesh, Tamil Nadu and Karnataka are in process of enacting the necessary legislation. Minor ports in Orissa, Kerala and Goa are controlled either by ports and fisheries departments, or by public works departments, or by transport departments.

III Port Performance

Traditionally, the study of competition among ports has focused on hinterland (the interior region served by each port), which was initially defined on the basis

of the rail rates from the ports to the interior. Later, port competition studies began to consider forelands (the overseas region served by each port) and the combined water-port-land rate advantages [Weigend 1958; Draine 1963]. Continuing to this vein, explanations of port competition have been extended to include other factors such as labour costs and productivity, rail connections, port access, and land availability [Kenyon 1970; Mayer 1978]. Hoare (1986) found overlapping hinterlands of ports of UK, and concluded that concept of relatively exclusive port hinterlands no longer applies as well as it once did. Hinterland has been defined as "organised and developed land space which is connected with a port by means of transport lines, and which receives or ships goods through that port" [Weigend 1958].

An alternative hinterland/foreland approach for studying port competition is to look at the degree of traffic concentration in the port system. To assess changes in port system concentration, we have used the Gini coefficient, a widely used index that measures inequality. The Gini coefficient ranges from zero (perfectly even distribution) to one (perfectly concentrated distribution). The level of concentration is shown graphically using a Lorenz curve.¹⁰

Figure 2 (a, b, c, d) and Figure 3 (a, b, c, d) show the Lorenz curves for 1970-71, 1980-81, 1990-91, and 1997-98, for India's major ports and coastal states respectively. Table 3 presents the value of Gini coefficients and Lorenz ratios computed under two possible combinations – (i) port traffic of major ports, and (ii) combined port traffic of coastal states. In the latter case, port traffic considers traffic of both major and minor ports of coastal states. The important findings are presented below.

First, port system concentration increased from 0.222 in 1970-71 to 0.291 in 1980-81 for all major ports, which continued more or less unabated until 1990-91 (0.290). But since liberalisation of industrial and foreign sectors in 1991, the Gini coefficient declined drastically, (0.234 in 1997-98), although remained at a high level compared to 1970-71. This is more a reflection of rising import-intensity in all the hinterlands than that of export.

Second, we have found opposite result in case of coastal states. Here, port system concentration has fallen from 0.239 in 1970-71 to 0.230 in 1997-98. Obviously, inclusion of minor port traffic has changed the direction as well as distribution of traffic across the coastal states. In other

words, the importance of the minor ports has increased in recent period.

Thus, in the post-liberalisation period, a clear tendency of equalisation with and without minor ports in port system concentration is noticed. One plausible reason for this observation may be that most states are trying to utilise minor ports due to limitation of capacity of major ports.

Measures

In spite of the considerable fluctuation of overseas trade through Indian ports from year to year, one sees a picture of general growth of traffic among all the ports, particularly in the post-liberalisation period. A fall in inequality among Indian ports may mean a rapid rise in the value of commodities handled, or an absolute diversion of traffic away from the larger to the smaller and better equipped ports. A port grows by virtue of the trade it attracts. A weak growth of foreign trade

makes the port system volatile which forces the system to concentrate more on coastal trading. A fall in port system concentration does not always bring benefit to all the ports. Performance of a port depends on many factors which may be broadly divided into internal and external factors. External factors may be composed of trade orientation of the region in which the port is located, objectives of the local as well as central governments, and the geographical importance of the concerned location on the global map. All these factors doubtless have importance for the overall performance of a port. But these factors are admittedly beyond the direct control of the port authority. The internal factors include both geo-navigational as are considered here, and also those factors which determine the productivity of labour and capital (which again is influenced by technological developments). Due to lack of consistent information we could not employ these

Table 3: Lorenz Ratio for the Ports of India: 1970-1997

Observations	Lorenz Ratio*				No of Ports/Maritime States			
	1970-71	1980-81	1990-91	1997-98	1970-71	1980-81	1990-91	1997-98
Port Traffic of Major Ports	0.356 (0.222)	0.373 (0.291)	0.367 (0.290)	0.295 (0.234)	9	11	12	12
Port Traffic of Coastal States**	0.325 (0.239)	0.300 (0.227)	0.288 (0.232)	0.285 (0.230)	9	9	9	9

Notes: * Numbers in parentheses refer to the Gini coefficient.

** Includes both major and minor port traffic.

Table 4(a): Weights of Port Performance Indicators: PCA

Variables	1985-86		1991-92		1996-97	
	Weights	Rank	Weights	Rank	Weights	Rank
TRT	-0.536	7	0.131	6	0.778	3
PBWT	0.414	6	0.457	4	0.903	1
PITWB	-0.639	8	-0.655	8	-0.544	8
OSBD	0.892	1	0.808	2	-0.183	7
BOR	0.561	5	0.698	3	0.831	2
BTR	0.769	4	0.891	1	0.122	5
PTOS	0.789	3	-0.561	7	-0.155	6
RRT	0.881	2	0.116	5	0.416	4

Table 4(b): Port Performance Index (PPI): PCA

Major Ports/Year	1985-86		1991-92		1996-97	
	PPI	Rank	PPI	Rank	PPI	Rank
Kandla	13.45	1	9.34	2	13.62	1
Mumbai	7.83	5	1.75	11	10.57	2
JNPT	-	-	3.09	9	7.96	6
Mormugao	11.32	2	9.37	1	5.45	10
New Mangalore	3.69	8	3.35	8	5.04	11
Cochin	2.45	10	1.83	10	4.10	12
Tuticorin	6.11	7	3.67	7	7.75	7
Chennai	9.14	4	4.72	4	9.79	3
Vizag	7.74	6	6.41	3	8.11	4
Paradip	3.27	9	4.19	5	8.03	5
Calcutta	0.68	11	-0.48	12	5.97	9
Haldia	9.34	3	3.89	6	6.57	8
Mean	6.82		4.26		7.75	
SD	3.97		2.93		2.65	
CV	0.58		0.69		0.34	

Note: * Not in operation.

productivity-augmenting factors in determining the port performance indicator. In lieu of these, we have taken into account two types of financial performance indicators which have embodied the net outcome of labour and capital productivity. We have tried to build a composite index called port performance index (PPI) across all major ports in order to test whether a fall in port system concentration implies increasing competitiveness in Indian port system.

We have taken eight individual port performance indicators for all the 12 major ports for three different time points over the period from 1985 to 1996 to judge their relative performance. These include (i) ship turn-round time (TRT), (ii) pre-berthing waiting time (PBWT), (iii) percentage of idle time at berth to time at working berth (PITTWB), (iv) output per ship berth day (OSBD), (v) berth throughput rate (BTR), (vi) berth occupancy rate (BOR), (vii) operating surplus per tonne of cargo handled (PTOS) and (viii) rate of return on turnover (RRT). Basic definitions of these performance indicators are given in Appendix 1. The basic limitation of the conventional method of construction of PPI is that while combining the performance indicators they give subjective ad hoc weights to different indicators. This could lead to unwarranted results. To overcome this limitation, we have employed the well-known multivariate technique of factor analysis from which the weights of the individual performance indicators are derived on the basis of principal component analysis (PCA) [Fruchter 1967].

In the PCA approach, the first principal component is that linear combination of the weighted values of the variables which explain the maximum of variance. Hence,

here the sole objective is to explain the variance across ports for each of the variables at a particular point of time. This limitation is inherent in such a proposal.

Indicators

We have at our disposal values of eight port performance variables for three different years across all the 12 major ports. These years are 1985-86, 1991-92, and 1997-98. Due to limitation of data, we have restricted our analysis to three years only. The last two years help us to evaluate the impact of performance differentials on the concentration of port systems in the post-liberalisation period.

The details of the factor loadings derived from the principal component analysis are given in Appendix 2. The weights derived from PCA are presented in Table 4 (a), and the PPI in Table 4 (b). A few observations are in order.

We have not found a single variable that has emerged as the most influential factor in all the years. However, looking at the two consecutive good rankings of OSBD in 1985-86 and 1991-92, it is obvious that OSBD has played an influential role in determining the performance of an indi-

vidual port in the first two years. Similarly, BOR has been found to be an important determinant of port performance in 1991-92 and 1996-97. It can therefore be concluded that two of the asset performance indicators (OSBD and BOR) have emerged as influential factors in determining PPI.

In the post-liberalisation period, India has witnessed a rise in her overseas trade volumes, particularly between 1993-94 and 1996-97. The lion's share of this trade was carried through her ports, and this was reflected in the port capacity utilisation rate. During the period from 1991-92 to 1996-97, Indian ports have been over-utilised at an average rate of 102 per cent per year. So, it is quite likely for the rate of congestion to increase during this period. Consequently, two of the operational performance indicators, PBWT and TRT and one asset performance indicator BOR became the three most influential variables in determining performance of an individual port.

Contrary to general belief, financial performance indicators like PTOS and RRT have emerged as factors of low importance in determining PPI in the last two years. However, these two financial performance

Table 4(d): Share of Major Ports in Total Indian Port Traffic

Ports	1970-71 (Per Cent)	1980-81 (Per Cent)	1985-86 (Per Cent)	1990-91 (Per Cent)	1998-99 (Per Cent)
Kandla	2.08	10.88	13.79	12.96	16.16
Mumbai	18.56	21.10	20.32	19.02	12.30
JNPT	.	.	.	1.34	4.66
Mormugao	14.22	17.10	13.48	9.81	7.17
New Mangalore	**	1.19	3.08	5.28	5.65
Cochin	6.21	6.50	4.41	4.79	5.04
Tuticorin	**	3.18	3.53	3.34	4.04
Chennai	8.95	12.90	15.17	16.14	14.00
Vizag	11.27	12.57	13.30	12.78	14.18
Paradip	27.90	2.78	2.78	4.53	5.21
Calcutta	7.98	5.04	3.48	2.71	3.63
Haldia	2.80	6.76	6.65	7.31	7.96

Notes: * Not in operation. ** Insignificant share.

Table 4 (c): Rank of Ports in Individual Performance Indicators

Ports	TRT (Days)		PBWT (Days)		PITTWB (Per Cent)		OSBD (Tonnes)		BOR (Per Cent)		BTR (Per Cent)		PTOS (Rs Crore)		RRT (Per Cent)	
	1985-86	1996-97	1985-86	1996-97	1985-86	1996-97	1985-86	1996-97	1985-86	1996-97	1985-86	1996-97	1985-86	1996-97	1985-86	1996-97
Kandla	6	11	10	12	1	2	2	4	1	1	2	2	2	11	1	2
Mumbai	10	12	11	11	9	6	8	11	3	5	9	11	1	4	6	10
JNPT	.	4	.	8	.	3	.	9	.	7	.	7	.	2	.	4
Mormugao	7	8	8	1	3	5	1	1	7	9	1	1	7	12	4	12
New Mangalore	8	2	5	4	10	11	10	12	6	12	8	6	8	6	8	1
Cochin	4	1	1	3	11	10	9	6	10	11	10	10	9	7	9	11
Tuticorin	2	3	2	5	8	8	7	10	9	2	6	9	6	10	3	3
Chennai	3	10	3	10	7	7	5	8	2	4	4	8	3	8	2	5
Vizag	5	6	6	6	6	1	4	3	8	6	5	4	5	9	5	6
Paradip	9	5	9	7	4	4	6	7	11	3	7	5	10	5	10	9
Calcutta	11	9	7	9	5	9	11	5	4	10	11	12	11	1	11	7
Haldia	1	7	4	2	2	12	3	12	5	8	3	3	4	3	7	8

Note: * Not in operation.

variables played a key role in determining PPI in 1985-86.

Similarly, PITTWB has emerged as an unimportant factor. Incidentally, weight of PITTWB is fixed at eight in each of the three observation years, and it has been added as a negative factor in the index.

Let us now touch upon the inter-port variations of each of the eight performance variables as they are given in the form of raw data over time. The values of the mean, SD and CV of the raw indicators of port performance are given in Appendix 3. Except OSBD, BTR, PTOS and RRT, the coefficients of variations (CV) for the rest of the variables have been rising over the years. Among these four variables, only RRT has become more even over time. That is, the value of CV of this variable has fallen from 0.64 in 1985-86 to 0.41 in 1991-92 to 0.19 in 1996-97. In contrast to this, PBWT displays the highest disparity – more than doubling from 0.33 in 1985-86 to 0.76 in 1996-97. This is a reasonably good indicator of the congestion in a port.

Let us now concentrate on Table 4(b) that presents the values of the performance indicators of 12 major ports over three different time points. First, the CV of PPI has declined substantially in 1996-97 (0.34) even after rising from 0.58 in 1985-86 to 0.69 in 1991-92. Thus there has been a tendency toward equalisation of inter-port performance index after liberalisation. This is also evident from higher mean and lower SD. Second, the average performance of the west coast ports has been slightly better than that of the east coast ports, and the first two ranks are held by the former ports. Interestingly, the first four ranks have remained unchanged since 1991. In order of ranking, these ports are Kandla, Mumbai, Chennai and Vizag. They also hold the first four positions in India's total port traffic since 1970-71. Their current (1998-99) shares are as follows: Kandla 16.16 per cent; Vizag 14.18 per cent, Chennai 14 per cent and Mumbai 12.30 per cent. Table 4(d) presents the shares of the major ports from 1970-71 to 1998-99. It appears that some sort of scale economy exerts its positive impact on the performance index. A look at Table 4(c), which presents the ranks of individual ports in raw individual performance indicators, makes it clear that except Chennai, Vizag and Haldia, the other ports of the east coast have been gradually retreating in terms of most of the indicators. Finally, there is substantial lack of symmetry among the

ports in terms of individual performance indicators.

IV Port Performance and Hinterland Income

Any interested reader can verify that the higher the overseas traffic of a port the higher the value of the performance index. It is generally argued that a rising hinterland/foreland always helps the port to sustain its growth. We have tried to investigate the factors responsible for the performance of a port. To test this hypothesis, we have used here three independent variables for the year 1996-97 – (i) share of overseas port traffic, (ii) port tariff, and (iii) per capita net state domestic product (PCNSDP). This relationship may be captured in the following function:

$$Y = \alpha + \beta X_1 + \gamma X_2 + \delta X_3 + e$$

where Y = port performance index, X₁ = port tariff, X₂ = share of overseas traffic, X₃ = PCNSDP and e = error term. From the standard regression, a high value of \bar{R}^2 will be reflected in lower e. The fitted results of this regression (OLS) are presented in Table 5 with corresponding values of the coefficients, t-statistic, \bar{R}^2 , DW and F-statistic for the year 1996-97.

The most interesting finding is that port performance is highly contingent upon overseas traffic, the coefficient of which is high (0.176), positive and significant (t=2.08). Port tariff and PCNSDP have turned out to be insignificant in influencing PPI. The definition of port tariff used here prevents the drawing of any rigorous conclusion. In fact there are numerous rates of tariff levied on various items. Naturally therefore, we have here considered only the vessel related charges as levied under Indian Ports Act 1908 and the Major Port Trust Act 1963. Other charges are not easily comparable. The most plausible explanation for lower t-statistics of PCNSDP may be that given the size of the non-coastal states, even a moderate trans-

port network leading to the ports may have sufficient strength to invalidate the attempt at limiting the contour of hinterland to the concerned state only. Hence, the traditional concept of hinterland (which calls for the use of regional income) needs be modified for successful application to such an analysis. Conversely, this can be taken to imply lower competitive advantage even of a specialised line of production in any region.

The above result indicates that differential levels of overseas consignment are the most influential factor in determining port performance differentials. One major limitation of the present study is its failure to incorporate the necessary transport linkage between the port, manufacturing belt, and the hinterland. This is reflected in low value of \bar{R}^2 . Now the question is: How can the PPI be improved? The answer from this paper is rather simple and obvious: under no situation should export consignment be compromised. This will not only improve port performance but also help initiate positive steps in terms of transaction economies thereby facilitating the ongoing globalisation programme.

Openness of a country means the degree of its involvement with global trade and economic activity. When a country opens her economy, it becomes necessary to strengthen her port systems to sustain the rising overseas trade.

The globalisation process during 1991-92 to 1995-96 has enhanced the importance of international trade in the hitherto closed economy of India [Mehta 1997]. To be precise, the India's share of trade in GDP has increased to more than 24 per cent in 1995-96. During the 1990s, a higher growth has been recorded in exports relative to imports resulting in a decline in trade deficit from the level of US \$ 5-6 billions per annum in 1980s to around two billions in 1994-95. In 1995-96, trade deficit increased to US \$ 4.5 billion. A large number of policy measures, which were in use for the control of imports, have been dis-

Table 5: Regression of PPI on Overseas Traffic, PCNSDP and Port Tariff, 1996-97

Independent variables	Coefficients	t-statistics	F value	\bar{R}^2	Adjusted \bar{R}^2	DW
Constant	3.871	0.715	3.004	0.530	0.354	1.680
Port tariff	0.051	0.009				
Overseas traffic	0.176	2.080				
PCNSDP	0.002	0.480				

Notes: 1 Port tariff counts only vessel related charges levied under the Indian Ports Act, 1908 and the Major Port Trust Act, 1963 as other port charges are not comparable.

2 Conversion factor for tariff calculation is taken at 1 US \$ = Rs 43.50.

No of observations 12

Dependent variable = PPI

Independent variables = Port tariff, Overseas traffic, PCNSDP

mantled. Also a number of quantitative restrictions, which were imposed in the earlier protectionist regime, have been done away with.

Due to our traditional pessimism towards overseas trade, and with some measures taken in the post-liberalisation period, our port capacity utilisation rate has again crossed the limit: 108.75 per cent in 1951-52 and 105.60 per cent in 1996-97 (Table 6). This is specifically true for the ports of Kandla, Mumbai, Chennai, and Vizag that have been continuously suffering from supply-side constraints (i.e. lower capacity) since liberalisation. Beyond the performance indicators so far dealt with, port utilisation depends on the economic characteristics of the hinterland and on the type and modality of transport linkages. Why are some ports overutilised and others are not? The traditional answer is probably a sort of unbalanced growth of manufacturing belts as evolved over time across the country in general and concentration in and around the ports of Kandla, Mumbai, Chennai, and Vizag in particular. As a matter of fact, these are the country's top four ports according to their annual cargo throughput and performance as we have seen in the previous section. Also, these are the ports of four coastal states which contribute the largest share in India's manufacturing value added – 12.75 per cent, 23.86 per cent, 10.32 per cent and 7.10 per cent in the year 1996-97.

It is clear from Table 6 that India's overseas port traffic intensity reached the lowest level of 66.91 per cent in 1991-92, and naturally the coastal traffic intensity rate touched the highest level of 33.09 per cent in the same year. It is also interesting to note that a fall in overseas port traffic intensity means a rise in coastal traffic intensity that is shown at intervals of 10 years from 1951-52 to 1996-97. This means that during the lean period of overseas traffic, per se, port systems had been used for coastal trade. Although Indian ports handled 4.50 MT of coastal cargo in 1951-52, which at the end of 1996-97

became 62.75 MT, coastal traffic intensity of all the major ports except Kandla has been rising faster than overseas traffic intensity in the post-liberalisation period. While this has reduced the burden on land transport, port infrastructure has failed to exert its favourable impact on export competitiveness. The output per-ship-berth-day and ship turn-around-time at major ports have worsened in the post-liberalisation period. The situation is aggravated in case of old ports like Calcutta where average turnaround time of 9.8 days is really serious. Likewise, its 77 per cent capacity utilisation is extremely low compared to the all-India average of 105 per cent. The situation appears much more grave when one considers costs. It is 40 per cent cheaper to ship from Singapore to Mumbai than from Singapore to Calcutta. Given that international ship turn-around times range between 3 to 10 hours rather than a week or more, it becomes clear why the capacity utilisation of Calcutta port is so low. Beyond the proximate causes, declining water draft and the riverine nature may be the two main factors for the lower values of the performance indicators of Calcutta port [Sau 1990].

Again, during the last 50 years, Indian ports are becoming more and more engaged not only in imports but also in coastal domestic traffic. It can be noted from Table 6 that the export-import ratio has fallen from 137.75 per cent in 1951-52 to 54.19 per cent in 1996-97. This is a direct reflection of our rising trade deficit. Some emerging trends of a hitherto semi-closed economy are obvious from Table 6. First, shortfall in port capacity will be a major concern in the coming years as liberalisation gains further momentum incorporating the agricultural sector also. (In 1996-97 port traffic was 227.26 MT against the capacity of 215.21 MT.) Second, increasing trade orientation (openness) has halted the fast rate of growth of coastal traffic since 1991. For example, coastal traffic has grown at an average annual rate of 26.30 per cent from 1951-52 to 1991-92, while overseas

traffic has grown by 12.69 per cent per annum. This trend has completely reversed after 1991. Although overseas traffic has been rising at approximately the same rate (11.39 per cent) since 1991, that of coastal traffic has fallen to 4.21 per cent. While this is certainly an encouraging symptom from the viewpoint of the country's openness, the export intensity of overseas traffic has been declining at a faster rate in the post-reform period (5.53 per cent per annum during 1991-92 to 1996-97 as against 1.14 per cent per annum during 1951-52 to 1991-92). This means that larger part of import passed through overburdened ports of India with a rising magnitude of openness.

Further study must be undertaken to see whether rising imports through Indian ports is a barrier to Indian export. Given that export consignment is always contingent upon timely supply, if the port authorities do not have any special incentives for export shipment, they cannot but use the existing capacity for import traffic only. Moreover, in such an endeavour, serious attention must be focused on the origin and destination of the cargo composition before any full-fledged policy initiative for future investment in port development is undertaken.

V Concluding Remarks Policy

On July 3, 1997, Jawarlal Nehru Port Trust (JNPT) signed a 30-year concession agreement with Nava Sheva International Container Terminal, a P and O Ports led consortium, to build, operate and transfer (BOT) a container terminal. The project is under implementation. This is India's first port privatisation programme. It should have been a catalyst for across the board changes in India's port industry. But to date, concession agreements have been signed only at JNPT and Tuticorin. On the contrary, India's major ports have been remained completely outside the purview

Table 6: Port Traffic, Port Capacity and Openness Scenario

Year	Port Capacity (MT)	Port Traffic (MT)			Port Utilisation Rate (Per Cent)	Traffic Intensity (Per Cent)		EX-IM Ratio of Overseas Port Traffic (Per Cent)	Openness Rate (Per Cent)
		Overseas	Coastal	Total		Overseas	Coastal		
1951-52	20.00	17.25	4.50	21.75	108.75	79.31	20.69	137.75	18.00
1961-62	36.67	23.83	9.18	33.01	90.02	72.19	27.81	120.50	11.00
1971-72	59.55	51.89	7.30	59.19	99.40	87.67	12.33	115.49	9.00
1981-82	104.45	72.01	15.97	87.98	84.23	81.85	18.15	81.02	17.00
1991-92	169.23	104.81	51.84	156.65	92.57	66.91	33.09	74.92	17.00
1996-97	215.21	164.51	62.75	227.26	105.60	72.39	27.61	54.19	22.00

Notes: Port utilisation rate = (Port traffic/Port capacity) *100; Overseas traffic intensity = (overseas traffic/Total traffic) *100; Coastal traffic intensity = (Coastal traffic/Total traffic) *100; Openness rate = [(Exports + Imports)/GDP] *100

of the ongoing globalisation programme. The story in minor ports is not any different. The only two privatised minor ports that are functioning today are Mundra and Pipavav. Both are located on the coast of Gujarat. The involvement of the state government is quite substantial in these two private port projects in terms of equity and administration.

The reasons for the slow-down in Indian port development are many. One of the main reasons is the low plan investment in the transport sector as a whole, and only a very insignificant part of it devoted to ports over the half century after independence.¹¹ It is clear from Table 7 that the share of the transport sector in total plan outlay has fallen from 22.10 per cent during the First Five-Year Plan (FYP) to 13.10 per cent during the Eighth FYP. Moreover, the share of ports in the transport sector has fallen from 7.31 per cent in the First FYP to 6.34 per cent in the Eighth FYP. It is surprising to note that such a crucial infrastructure sub-sector like ports is the worst affected area in terms of both allocation and utilisation of development fund during the eight plans. Again, in all the plans except the fourth, fund utilisation in port sector has always been marred by inefficiency. Failure to utilise the disbursed fund may have been responsible for reduced allocation in the subsequent period. And as a matter of fact, due to this low investment, adequate capacity has not been created. In fact, the government has failed to understand the crucial role the port sector can play in the liberalised regime. But this sort of reasoning cannot go beyond the proximate explanation. The more fundamental cause must be sought in the lack of export orientation of our investment policies starting from the Second Plan to the Eighth. And this is more so for a country where ports account for more than 90 per cent of tangible trade (except information technology and horticulture products).

Apart from low plan investment, awareness, direction and understanding of the port industry has been lacking. Port authorities must understand both the revenue earning capacity and the catalytic role of ports. There is an urgent need for a co-ordinated policy for regulating and encouraging investments from both public and private sectors in ports. One may be surprised to note that although all the 12 major ports are controlled by the government of India through the ministry of surface transport, the government still does not have a coordinated port policy. It has

only some guidelines issued from time to time on ad hoc basis. Again, some of the maritime states like Gujarat and Maharashtra have some port policies of their own but they too lack the required direction. There is no doubt that the country needs a commercial revolution in the port industry. But to do this Indian ports need to go through a process of technological development which demands monetary and fiscal policies which are no less than revolutionary.

Although the federal government and its respective maritime states have opened the sector for private investments, experience suggests that investors face an unwilling bureaucracy in getting the projects cleared. The major trouble is that quite a large number of clearances are required which are controlled by union and state governments. And there is lack of transparency [Sarbh 1998].¹²

Another very critical factor that has accounted for poor performance in India's waterfront industry is the absence of inter-port competition which has been the source of substantial productivity increases in national port systems in many countries. Shielding the domestic ports against competitive pressures as a matter of government policy is now a habit that dies hard.

The consequences of all these shortcomings for the Indian economy continue to be severe. In the liner trades very few carriers serve India's ports through direct calls. Because of the high costs of operation of modern deep-sea line haul tonnage carriers cannot accept the long waiting times at Indian ports. Most general cargo traffic, particularly container traffic, takes

place through transshipment at Colombo, Dubai or Singapore. The extra transit time and additional costs incurred by Indian importers and exporters are substantial. The costs of excessive ship waiting times in ports due to slow cargo processing in the case of bulk trades are passed on to the ultimate user thereby raising the price of imports unnecessarily and undermining the competitiveness of Indian exports in the international markets.

Apart from all micro level incongruities, in India, cargo and vessel handling charges are responsible for distorting the inter-port competitive environment. Look at Table 8 for vessel related charges of major ports of India for the year 1997-98. It is reasonably true that port tariff dictates cargo flow. In India, port tariff is a combination of cargo related charges and vessel related charges – those levied under the Indian Ports Act, 1908 and Major Port Trusts Act,

Table 8: Vessel Related Port Tariff of Major Ports of India, 1996-97

Ports	Tariff US \$/GRT	Rank
Kandala	0.470	3
Mumbai	0.405	1
Jawarlal Nehru	0.440	2
Mormugao	0.518	7
New Mangalore	0.475	4
Cochin	0.560	8
Tuticorin	0.480	5
Chennai	0.510	6
Vizag	0.615	9
Paradip	0.720	10
Calcutta	0.830	12
Haldia	0.830	11

Notes: 1 Tariff rate includes port dues, pilotage and berth hire charges levied on foreign vessels for single entry to the port only.
2 Higher tariff means lower rank.

Source: Scales of Rates of all major ports of India.

Table 7: Plan Investment in Transport Sector : Allocation and Utilisation (Per cent)

Sectors	1st FYP 1951-52	2nd FYP 1956-61	3rd FYP 1961-66	4th FYP 1969-74	5th FYP 1974-79	6th FYP 1980-85	7th FYP 1985-90	8th FYP 1992-97
Port sector								
FUR	75.68	73.33	60.78	127.69	85.46	112.06	123.01	64.72
STTSPO	7.31	3.46	10.97	7.58	10.54	5.36	5.43	6.34
Road sector								
FUR	108.89	92.02	148.15	98.97	125.72	113.03	121.83	125.42
STTSPO	26.68	20.25	21.29	33.88	24.96	28.47	22.96	22.88
Railway sector								
FUR	81.27	80.33	148.99	88.95	93.69	129.12	134.17	118.75
STTSPO	52.77	69.28	63.80	40.84	40.63	42.22	54.47	48.50
Civil aviation sector								
FUR	79.31	113.95	39.09	37.19	87.24	111.41	256.99	177.54
STTSPO	5.73	3.31	3.94	7.90	6.22	7.11	3.35	7.28
Total transport sector								
FUR	85.77	84.68	142.15	98.09	102.27	115.57	130.17	115.78
STPO	22.10	23.50	23.10	16.00	14.10	12.80	13.50	13.10

Notes: FUR means Fund utilisation rate (Plan expenditures/Plan outlay); STTSPO means Share in total transport sector plan outlay; STPO means Share in total plan outlay.

1 Plan outlay considers both central and state plan outlays.

2 Road sector does not include allocation made for road transport sector.

3 Port sector does not include allocation made for shipping, IWT, lighthouse and lightships.

Source: Plan Document, Vol II, Ninth Five-Year Plan, Planning Commission, Government of India.

1963. To calculate vessel related tariff, we have taken berth hire charges, pilotage charges and port dues. Due to absence of compatible information on port tariff across all major ports, we have not taken cargo related charges.

From Table 8, one may notice that west coast ports have lower vessel related tariff than those of east coast ports. Except Calcutta and Haldia, all are sea ports, and all have quite stable approach channel. One important source of this disparity is that the individual port trust fixes the berth hire charges vis-a-vis pilotage charges as per its fiscal performance in the previous year. This is done in a very haphazard manner. The situation will be worse if cargo related charges are included. This monopolistic nature of tariff adjustment affects the entire port system. It is sometimes argued that annual incidence of intrinsically avoidable costs to the Indian economy occasioned by considerable demurrage charges, the extra expenditures of transshipment, congestion of ship and cargo handling installations could be as high as US \$ 1.5 billion. Moreover, the country's importers and exporters generally forego the ability to count on now universally common 'fixed-day-of-the-week' services offered by the international liner industry in response to the spreading practice of selling and buying on a 'just-in-time' basis. Because of uncertainties about the speed of cargo handling and the availability of transport services India's, traders and producers are forced to conduct their business with substantial buffer stocks. While no official estimates of the annual cost incidence related to such hedging are available, it may not be an exaggeration to put it at several billion US dollars.

Privatisation

A review of literature suggests that broadly three types of models have been adopted across the world for privatisation of port systems [Baird 1997]. In the first model, only the port operation part is transferred to the efficient private sector. This type of arrangement is referred to as a 'landlord' or 'tool' port. In this model, port land is still in public ownership, and regulatory activities are also the responsibility of the government. There are many examples of this type of arrangement, especially throughout North American and European ports, in which terminals are generally leased to the private sector.

In the second model, port operation and property rights are controlled by the pri-

vate sector. In this case, government controls regulatory matters and the conservancy of navigable approach channels. UK ports like Tilbury, Flixstowe and Harwich and ports of Australia are owned and operated by the private sector.

In the third model, all the three powers – regulatory, landownership and operation – become the responsibility of the private sector. With this, government does not have any role except to react in certain cases like pollution, accidents and threat to the sovereignty of the country. Three of the top 100 container ports, Southampton, Liverpool and Thamesport (all in UK) conform to this model. There are general cargo ports (not specialised in container) which belong to this category. Baird (1997) has shown that out of 100 top container ports in the world, seven ports are still managed by government (mainly ports in South Africa, India, Israel and Singapore). 88 ports conform to the first model, two ports to the second model and three ports to the third model.

A joint venture between public and private sector splits the costs and risks of a new port development, and this appears to be one of the main approaches currently used for port investment in China. Clearly, these privatisation methods can help facilitate an advanced port system while minimising state expenditure, and without any need to transfer ultimate property rights or regulatory control from the public sector.

Inefficient ports, through lack of integrated transport network, outdated work practices and obsolete facilities, can stall economic development. This is one of the main reasons why local governments are actively seeking private sector participation in their port sector usually via lease, concession, BOT, or joint venture arrangements. There is also a need to introduce efficiency and know-how of the private sector. Increasing specialisation and standardisation in the shipping and transport industry have resulted in the formation of expert multinational terminal operating companies, often subsidiaries of shipping lines, who know precisely how to meet the ever changing, and increasing needs of ports users. These firms benefit from economies of scale and learning through their wide geographic scope of activities.

There is also pressure to reduce the public sector budget but this does not necessarily mean that the government withdraws entirely from investing in its ports. Many examples of the first model demonstrate that the state may continue to be respon-

sible for provision of new infrastructure but that the private sector provides the superstructure such as cranes and terminal buildings. This is more a partnership approach in which the government still retains at least some degree of control over its ports industry. Even in BOT arrangements, the government generally retains its public port authority, may also impose restrictions on future tariff increases, share in port profits, stipulate minimum throughput targets, and keep property rights which revert to the government at the end of the contract period.

After many years of inconclusive deliberations the central government has taken steps to invite private interests to engage in the financing of new port facilities on a BOT basis. The first initiative was to issue a tender that called for the financing, construction, and subsequent operation of two new container berths at JNPT. The ministry of surface transport has recently announced its plans to issue during the next two years tenders for 21 new projects throughout the country's waterfront sector at an estimated cost of about US \$ 6.6 billion. The government through its ministry of surface transport has estimated that the cost of expanding India's port system to efficiently deal with cargo types and volumes projected to materialise during the next eight years will be of the order of US \$ 40 billion.

There are several flaws in the draft BOT concession agreement which was drafted by the ministry of surface transport. The main drawback is that investors' investments are not backed by legal statute although it is a common practice in leading south-east Asian countries and particularly in the US. Furthermore, the ministry asks investors to follow the same draft irrespective of location of the port system. Geo-technical and socio-commercial features of ports of India are not at all homogeneous. So there should be some adjustment and preferential incentives for private investment from the viewpoint of backward area development.

This is the time for a national debate on the possibility of corporatising the major port trusts, i.e., converting them from government agencies into public companies which are managed on the basis of commercial principles. This would be a right first step in the direction of ultimately freeing ports of the central government's benevolence altogether. International experience with port systems reform has repeatedly demonstrated that delegating

regulatory and institutional responsibility over ports to the local levels leads to major productivity improvements because of induced competition.

Future Research

Let us briefly summarise the major findings of the study. First, after 50 years of planning and protected industrial regime, although there was a fall in inequality among major ports, India has failed to strengthen her port sector. Geographically, the ports of eastern India have stagnated, while the same in west and south coasts have flourished. Second, contrary to conventional belief, performance of a port has been proved to be significantly dependent upon overseas cargo. Third, in the absence of an integrated policy of manufacturing belt, transport network and export orientation, existing capacity of the ports is being utilised for domestic coastal trade and imports. Fourth, allocation of funds by both union and state governments over the plan period has been found to be too low to utilise the potential of the huge coastline through development of trans-

port infrastructure.

These findings have very important policy implications for future development of Indian ports. In this light, further research into the extent to which such non-price factors as ports is responsible for our poor export performance is needed. The findings presented here are revisionist, and highly aggregative. Future studies will no doubt refine the methods and data used here, and revise our arguments. First, other theoretical approaches might be explored. New ways of thinking about growth could provide other models in which geographic dynamics and economic growth could be assessed jointly. Second, as further advances in the growth literature define the steady state more effectively, the robust-

ness of our results can be tested, and the analysis extended. Third, considering the mode of transport linkage with the ports, one should also examine the effectiveness of the economics of ports not only for practical implementation of the thrust area of liberalisation (that is, to raise export) but also for spreading India's halted urbanisation. For this, a study of this ecological phenomenon must be brought to the forefront of Indian economic analysis. **EPW**

Notes

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- 1 For a critical and comprehensive review see Martin (1999).
- 2 This new and popular wave of research work in the fields of 'new trade theory' and 'new economic geography' was pioneered in a series of seminal works which started about two decades ago: Dixit and Stiglitz (1977), Lancaster (1980), Krugman (1979, 1981) and Porter (1990).
- 3 A review of the literature suggests three possible relationships, with transportation having (i) a positive effect on the development process – the expansion in directly productive activities being a direct result of providing improved transportation facilities; (ii) a permissive effect on the development process, because transportation does not independently produce directly productive activities or subsequent increases in the level of economic growth; (iii) a negative effect occurring when an over-investment in transportation reduces potential growth in directly productive activity, and consequently leads to an absolute decline in the level of income per capita [Gouthier 1970].
- 4 Broadly speaking, there is at least one inland city in most of the coastal states where population size, wage rates and rental rates are higher.
- 5 Hirschman conjectured the then prevalent mode of operation of the promoters in the year 1958. After 40 years, we in India have neither any economics of transport nor any nationwide awareness of transport as an area of concern.
- 6 However, some recent studies have dealt with infrastructure facilities and income in general, for example, Elhance and Lakshmanan (1988), Binswanger et al (1989), Ghosh and De (1998a, 1998b).
- 7 The series of available CPIAL are large enough for the period of present study. But it is not available for all the states. Hence for those states for which the government does not estimate it, we have proxied by the CPIAL of the most adjacent and comparable state. This replacement is preferable to WPI and CPI for industrial workers of the all-India type.
- 8 Except Calcutta and Haldia ports, which are governed by a single port trust (called Calcutta

Appendix 3

Performance Variables	1985-86	1991-92	1996-97
TRT			
Mean	10.27	6.37	6.76
SD	2.75	1.82	2.24
CV	0.27	0.29	0.33
PWBT			
Mean	2.92	1.46	2.38
SD	0.97	0.74	1.80
CV	0.33	0.51	0.76
PITTWB			
Mean	35.73	34.17	31.63
SD	11.74	11.66	12.56
CV	0.33	0.34	0.40
OSBD			
Mean	3073.45	4458.42	5031.67
SD	11773.89	2506.94	2071.99
CV	0.58	0.56	0.41
BOR			
Mean	70.40	66.87	73.01
SD	8.34	12.73	15.85
CV	0.12	0.19	0.22
BTR			
Mean	99.63	116.33	143.10
SD	86.90	74.89	85.67
CV	0.87	0.64	0.60
OSTC			
Mean	1.21	2.34	5.71
SD	0.97	1.27	4.12
CV	0.81	0.54	0.72
RRT			
Mean	27.07	27.47	40.02
SD	17.33	11.33	7.55
CV	0.64	0.41	0.19

Appendix 1: Port Facility

- 1 Ship turn-round time (TRT) is the duration of the vessel's stay in port and is calculated from the time of arrival to the time of departure.
- 2 Pre-berthing waiting time (PBWT) means the time which a ship waits before getting entry into a berth.
- 3 Percentage of idle time at berth to time at working berth (ITTWB) is the ratio of total idle time and total working time while a ship is in the port.
- 4 Output per ship berth day (OSBD) means total tonnage handled, or distributed over the total number of ship berth days.
- 5 Berth throughput rate (BTR) means total cargo handled by a berth in a port.
- 6 Berth occupancy rate (BOR) is the time that a berth is occupied by ships.
- 7 Operating surplus per ton of cargo handled (PTOS) is derived from total operating surplus divided by total tonnage of cargo handled by the port.
- 8 Rate of return on turnover (RRT) derives from operating surplus divided by operating income of a port.

Appendix 2: Principal Component Analysis

The factor loading of the eight port performance indicators for three different years are given below from which the eigen vector is derived by the formula:

$$\text{Eigen vector} = (\text{factor loading}) / \sqrt{(\text{eigen value})}$$

where eigen value is the first value of the 'variance explained' column in the unrotated factor loading (pattern).

Variables	Factor Loadings (FL)					
	1985-86		1991-92		1996-97	
	FL	Rank	FL	Rank	FL	Rank
TRT	-0.536	7	0.131	6	0.778	3
PBWT	0.414	6	0.457	4	0.903	1
ITTWB	-0.639	8	-0.655	8	-0.544	8
OSBD	0.892	1	0.808	2	-0.183	7
ABOR	0.561	5	0.698	3	0.831	2
BTR	0.769	4	0.891	1	0.122	5
PTOS	0.789	3	-0.561	7	-0.155	6
RRT	0.881	2	0.116	5	0.416	4

- Port Trust), each of the remaining ports is governed by a separate port trust.
- 9 Basically, ports administration in India is governed by the following five acts – (i) Indian Ports Act, 1908; (ii) Major Port Trust Act, 1963; (iii) Dock Workers (Regulation of Employment) Act, 1948; (iv) Dock Workers (Safety, Health and Welfare) Act, 1986; and (v) The Merchant Shipping Act, 1958. There are other general enactments that have a bearing on ports like the Industrial Disputes Act, 1947 and Customs Act, 1962. The Environment (Protection) Act, 1986 and the rules/regulations framed thereunder are also relevant to port development and operations.
- 10 Mathematically, the Gini coefficient is calculated as:

$$G = 0.5 \sum_{i=1}^n |X_i - Y_i|$$

where n is the number of ports, X_i is the volume in per cent of the i-th port and Y_i is the expected per cent if the distribution were perfectly uniform, that is, $Y_i = 1/n$. The relationship between the Gini coefficient and the Lorenz curve is simple. The Gini coefficient is equal to the ratio of the area between the Lorenz curve and the diagonal line, relative to the maximum possible area (the entire right angle formed by the bottom and right axes and the diagonal).

- 11 Public gross infrastructure investments including stocks (PGII), as a proportion of GDP, and in per capita terms (PCPGII) at 1980-81 prices:

Year	PGII (Rs Crore)	PGII to GDP (Per Cent)	PCPGII (Rs)
1970-71	3,772	3.70	69
1975-76	5,043	4.30	83
1980-81	7,158	5.30	105
1985-86	8,426	4.80	111
1989-90	10,589	4.70	125

- 12 Due to lack of such services in case of port development at a place called Kulpi in West Bengal on the east bank of river Hooghly by Bengal Port (a joint venture between government of West Bengal and Mukand-Keventer Consortium and Associates), the promoting company has not yet received clearances from the ministry of surface transport, government of India even after four years of incessant efforts through all possible legal channels. To our knowledge, approximately 80 official meetings were held at Calcutta and New Delhi among Calcutta Port Trust, Bengal Port, West Bengal government and ministry of surface transport. This represents the likely scenario for future development of ports.

References

- Baird, A (1997): 'Privatisation Defined: Is it the Universal Panacea?', Transportation, Water and Urban Development Department, The World Bank, Washington, DC.
- Barro, R and Sala-i-Martin (1995): *Economic Growth*, McGraw Hill, New York.
- Binswanger, H P, S R Khandkur and M R Rosenzweig (1989): 'How Infrastructure and Financial Institutions affect Agriculture Output and Investment in India', Policy Planning and Research Working Paper No 163, Latin America and the Caribbean Country Department II, The World Bank, Washington, DC.
- Cootner, P (1963): 'The Role of the Railroads in US Economic Growth', *Journal of Economic History*, pp 477-521, December.
- Dixit, A and J Stiglitz (1977): 'Monopolistic Competition and Optimum Product Diversity', *American Economic Review*, Vol 67, No 1.
- Draine, E H (1963): 'Import Traffic of Chicago and Its Hinterland', Department of Geography Research Paper No 8, University of Chicago.
- Elhance, A P and T R Lakshamanan (1988): 'Infrastructure-Production System Dynamics in National and Regional Systems: An Economic Study of the Indian Economy', *Regional Science and Urban Economics*, vol 18, North Holland.
- Export Import Bank of India (1998): *Transaction Costs of India's Exports: An Analysis*, Mumbai.
- Fogel, R W (1964): *Railroads and American Economic Growth: Essays in Economic History*, John Hopkins Press, Baltimore.
- Fruchter, B (1967): *Introduction to Factor Analysis*, Affiliated East West Press, New Delhi.
- Fujita, M and T Mori (1995a): 'Structural Stability and Evolution of Urban Systems', *Regional Science and Urban Economics*, vol 34, no 8.
- (1995b): 'Why are Most Great Cities are Port Cities? Transport Nodes and Spatial Economic Development', *Working Papers in Regional Science*, no 175, Regional Science Graduate Programme, University of Pennsylvania, Philadelphia, PA.
- (1996): 'The Role of Ports in the Making of Major Cities: Self-agglomeration and Hub-effect', *Journal of Development Economics*, vol 49, pp 93-120.
- Gallup, J and J Sachs (1998): 'Geography and Economic Growth', conference paper, *Tenth Annual Bank Conference on Development Economics*, The World Bank, Washington, DC.
- Ghosh, B and P De (1998a): 'Role of Infrastructure in Regional Development: A Study over the Plan Period', *Economic and Political Weekly*, vol 33, nos 47-48.
- (1998b): 'Linkage between Infrastructure and Income among Indian States: A Tale of Rising Disparity', paper presented in the conference on 'Development, Displacement, and Disparity' during the last quarter century in India, Centre for Studies in Social Sciences, Calcutta, December.
- Ghosh, B, S Marjit and C Neogi (1998): 'Economic Growth and Regional Divergence in India: 1960 to 1995', *Economic and Political Weekly*, vol 33, no 20.
- Gouthier, H L (1970): 'Geography, Transportation and Regional Development', *Economic Geography*, Vol 46, No 4.
- Government of India (1996): *The India Infrastructure Report: Policy Imperatives for Growth and Welfare*, New Delhi.
- Hirschman, A O (1958): *Strategy of Economic Development*, Yale University Press, New Haven.
- Hoare, A G (1986): 'British Ports and their Export Hinterlands: A Rapidly Changing Geography', *Geografiska Annaler*, vol 68B, pp 29-40.
- Hunter, H (1965): 'Transport in Soviet and Chinese Development', *Economic Development and Cultural Change*, vol 14, pp 71-84.
- Isward, W (1956): *Location and Space-Economy*, MIT Press, Cambridge, Massachusetts.
- Kenyon, J (1970): 'Elements in Inter-Port Competition in the United States', *Economic Geography*, vol 46, no 1, pp 1-24.
- Kindleberger, C P (1996): *World Economic Primacy: 1500-1990*, OUP, New York.
- Krugman, P (1979): 'Increasing Returns, Monopolistic Competition and International Trade', *Journal of International Economics*, Vol 9.
- (1981): 'Trade, Accumulation and Uneven Development', *Journal of Development Economics*, Vol 8.
- (1991): *Geography and Trade*, MIT Press, Cambridge, Massachusetts.
- (1993): 'First Nature, Second Nature and Metropolitan Location', *Journal of Regional Science*, Vol 33, No 2, pp 129-44.
- (1995): *Development, Geography and Economic Theory*, MIT Press, Cambridge, Massachusetts.
- (1998): 'Space: The Final Frontier', *Journal of Economic Perspectives*, Vol 1, No 2, Spring, pp 161-74.
- Lancaster, K (1980): 'Inter-Industry under Perfect Monopolistic Condition', *Journal of International Economics*, Vol 10.
- Losch, A (1954): *The Economics of Location*, Fischer Verlag, Jena.
- Marjit, S and S Mitra (1996): 'Convergence in Regional Growth Rates: Indian Research Agenda', *Economic and Political Weekly*, August 17.
- Marjit, S and A Roychoudhury (1997): *India's Export: An Analytical Study*, OUP, Delhi.
- Martin, R (1999): 'The New Geographical Turn in Economics: Some Critical Reflections', *Cambridge Journal of Economics*, Vol 23, No 1, January.
- Mayer, H M (1978): 'Current Trends in Great Lakes Shipping', *GeoJournal*, vol 2, pp 117-22.
- Mehta, R (1997): 'Trade Policy Reforms, 1991-92 to 1995-96: Their Impact on External Trade', *Economic and Political Weekly*, vol 31, no 17.
- Peters, H J (1990): 'India's Growing Conflict between Trade and Transport', Policy Research Working Paper No 346, The World Bank, Washington, DC.
- (1992): 'Service: The New Focus in Manufacturing and Trade', Policy Research Working Paper No 950, The World Bank, Washington, DC.
- Porter, M (1990): *The Competitive Advantage of Nations*, Macmillan, London.
- Quah, D (1993): 'Galton's Fallacy and Tests of the Convergence Hypothesis', *Scandinavian Journal Economics*, Vol 95, No 4.
- Ray, A (1993): *Maritime India: Ports and Shipping*, Pearl Publishers, Calcutta.
- Rauch, J E (1991): 'Comparative Advantage, Geographic Advantage and the Volume of Trade', *The Economic Journal*, vol 101, pp 1230-44.
- Rostow, W W (1964): *The Stages of Economic Growth*, Cambridge University Press, Cambridge.
- Samuelson, P A (1954): 'The Transfer Problem and Transport Costs: Analysis of Effects of Trade Impediments', *The Economic Journal*, Vol LXIV, No 254.
- Sarbh, J (1998): 'Indian Port Policy: Where Next?', *Port Development International*, November.
- Sau, S N (1990): 'Economics of Calcutta-Haldia Port Complex', *Economic and Political Weekly*, Vol XXV, Nos 18-19.
- Taaffe, E J, R L Morrill and P R Gould (1963): 'Transport Expansion in Underdeveloped Countries: A Comparative Analysis', *Geographical Review*, Vol 53, No 4.
- von Thunen, J (1826): *The Isolated State*, Pergamon, London.
- Weber, A (1929): *Theory of the Location of Industries*, University of Chicago Press, Chicago.
- Weigend, G (1958): 'Some Elements in the Study of Port Geography', *Geographical Review*, vol 48, pp 185-200.