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PERFORMANCE OF MAJOR PORTS IN INDIA - INTER AND INTRA PORT ANALYSIS

Shafeeqe Abdul Kader[*] and Malini L Tantri[**]

Abstract

Instead of considering ports as one unit of analysis, the present paper explores the heterogeneity in their performance both at inter and intra-port levels through constructing a composite index of operational, financial, and trade indicators for the period 1990-91 to 2020-21. The empirical investigation helps us to argue that over the years the performance of each port (intra-port) has improved significantly but inter-port comparison presents a different picture. In particular, a few ports like JNPT stands out as an outliner due to consistently better performance in all the parameters, whereas a few others like Haldia, Kolkata and Cochin ports lag far behind the performance ladder due to consistently poor performance in at least two of the performance indicators.

Introduction

Institutions, infrastructure, and incentives are instrumental in driving the performance of any sector of the economy including the trade sector, which in turn is acclaimed as an engine of growth. Trade policy, across the globe, however, to begin with, placed a greater emphasis on incentives at the cost of institutional and infrastructural arrangements. However, of late, it is realised that incentives can, at the most, encourage exporters and attract investment and also that by themselves, incentives do not ensure a better performance nor improve competitiveness which is very necessary for survival at the global level (Tantri, 2016). In fact, competitiveness in international trade is defined and differentiated not just by economies of scale, costs and quality of product but also based on the available set of institutions and infrastructure in place for facilitating trade(Porter, 1998). The effectiveness of trade, in acting as an engine of growth, depending on the quality of infrastructure and its performance (Limao & Venables, 2001; Nordås & Piermartini, 2004; Bensassi et al., 2015). As a result, there has been an emphasis on shifting the focus towards building a trade-related infrastructure base (meant to reduce trade-associated costs and improve institutional arrangements involved in trade) as part of improving the doing-business status of a given economy and also its position on the global economic map (Lall, 1999; Veloso & Soto, 2001; Demombynes & Kiringai, 2011).Amongst all other indicators of performance, the port performance or port efficiency has the most significant impact on the international trade (Nordås & Piermartini, 2004).

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This, among other, is largely due to significantly higher percentage share of maritime trade as compared to other modes like road and air. For 2015, world seaborne trade was estimated at 80 percent of total merchandise trade in terms of volume and 55 percent in terms of value (UNCTAD, 2016).In India, the trade share through the maritime route comes around 95% of trade volume and 68% of trade value in 2020-21 (MoS, 2022). Not surprisingly, a due emphasis has been placed on the development of ports even before Independence. For instance, the first Port Act was enacted in1908 (The Indian Port Act-1908). This was subsequently followed by a few major policies in post-Independence India, i.e., The Dock Workers (Regulation of Employment) Act 1948; Merchant Shipping Act 1958; The Major Port Trusts Act 1963; The Merchant Shipping (Form of Certificate of Insurance for Civil Liability for Oil Pollution Damage) Rules 1985; The Multimodal Transportation of Goods Act 1993; Amendment of Multimodal Transportation of Goods Act 1993; The Dock Workers (Regulation of Employment) (Inapplicability to Major Ports) Act 1997; Major Ports Regulatory Authority Bill 2009; Port Entry Rules 2012. The role of the port in the economic growth of India, especially in trade competence, is well established in the literature (MoS, 2017; Roy, 2004; Prakash et al., 2013; ECMB, 2017). In this backdrop, the review of literature on the port sector of India reveals that (Deshmukh, 2005; Gaur et al., 2011; Monterio, 2010; Padmasani et al., 2016 Rajasekar et al. 2012; 2013; 2014; Regamani et al., 2015)these studies have accorded importance to the performance analysis of the port sector. However, a comprehensive study, which captures different dimensions of performance like operational, financial and trade for a long time is missing in the literature. The available studies either focus on a single indicator or a short period for measuring the performance of the port sector (see for instance; Monteiro, 2010; Padmasani & Tamilselvi, 2016) or they are descriptive(Regamani & Venkatraman, 2015; Gaur et al., 2014) or based on reviews of studies or reports (Mantry & Ghatak, 2017). Some of the studies (Rajasekar & Deo, 2012; 2013; Rajasekar et al., 2014) have mainly investigated the relationship between the variables of efficiency and size of ports, while ignoring to account for port efficiency other than operational efficiency and its influential role.

Moreover, these studies have considered ports as one unit of analysis and heterogeneity in their nature, operation and performance is not well acknowledged in the literature. This is very important considering the continuous effort put in by both Union and respective state governments to use the port as an instrument to boost their industrial expansion and thereby trade participation. Despite this, India is still struggling to make its mark in the global top ten ports at the same time other Asian economies are faring far better. For instance, the share of ports in world trade and development of ports, one can see an Asia-centric growth in that out of 10 top ports 9 are in Asia in 2015of which 7 happened to be Chinese ports (Ernst & Young LLP, 2017).

Besides this, there is a lack of a comprehensive study to analyse the performance of the port sector, capturing all the relevant elements and dimensions of performance reflecting a greater understanding-with a specific focus on how its performance has changed against the backdrop of the changing landscape of economic reforms and whether or not there exist variations in their performance across ports. If so, what explains the same? In this context, the present paper fills this gap in the

literature by analysing the performance of the port sector in India by using a composite index incorporating operational, financial, and trade indicators at the disaggregate levels.

The rest of the paper is organised as follows; the section following this provides a brief overview of major ports in India besides outlining data and the approach of the study. The third section discusses empirical results that pertain to the performance of major ports at inter and intra levels. The last section summarises the key findings of the paper and flags key researchable issues.

A Brief Overview of Major Ports in India

India has a coastline of 7,517 kilometres with 12 major ports, and 205 notified non-major ports along the nine coastal States and Islands. Major ports are those which are administered by the Union Government, listed as entry 27 of List I, Schedule VII of the Constitution of India, and are a central subject. The State Governments administer non-major ports and are listed under the concurrent list. The current study is confined to major ports in India and Table One gives a brief overview of major ports in India. The institutional structure of the Indian port sector is defined by major policies and Acts pertaining to the sector. The Indian Ports Act of 1908, a comprehensive Act, lays down the basic rules regarding the administration of the port sector. The major ports administration was based on the rules and regulations made by the Major Port Trust Act of 1963. This Act has been repleaded by the government by enacting the Major Port Authorities Act of 2021 to revamp the administration, control and management of major ports. Along with bringing changes in the Acts, the government of India has embarked on the Sagarmala programme, approved by the Union cabinet in 2015 to promote port-led development in the country. The programme has identified 805 projects worth Rs. 5.54 lakh crores till now.

Table. 1: A Brief Overview of Major Ports in India(Study coverage)

Sl No:	Port Name & (Established Year)	State & (Coastline)	Ownership	Other Features
1	Kolkata & Haldia (1870)	West Bengal (157.5)	Central Government	Oldest and only riverine major port.
2.	Paradip (1965)	Odisha (476.4)	Central Government	Artificial Lagoon Port
3.	Visakhapatnam (1933)	Andhra Pradesh (973.7)	Central Government	Natural Harbour and deepest draft
4.	Kamarajar (Ennore) (2001)	Tamil Nadu (906.9)	Corporate Ownership	Artificial Harbour
5.	Chennai (1881)	Tamil Nadu (906.9)	Central Government	All-weather artificial harbour
6.	V O Chidambaranar (Tuticorin)(1979)	Tamil Nadu (906.9)	Central Government	Artificial Harbour
7.	Cochin (1930)	Kerala (160.5)	Central Government	Natural Harbour
8.	New Mangalore (1975)	Karnataka (280)	Central Government	Artificial Lagoon Port
9.	Mormugao (1963)	Goa, Daman & Diu (652.6)	Central Government	Natural Harbour
10.	JNPT (1989)	Maharashtra (569.7)	Central Government	All Weather Tidal Port
11.	Mumbai (1873)	Maharashtra (569.7)	Central Government	Natural Harbour and Second oldest port
12.	Kandla (1950)	Gujarat (1214.7)	Central Government	Tidal Creek Port

Data and Methodology

The central question of the paper is to investigate how major ports are performing at disaggregate levels (both intra and inter port levels) and, to understand if there have been any changes in performance over the years. The inter port provides a performance analysis of each port in comparison with others, while the intra-port analysis examines how far each port under reference is faring in the performance ladder over the years. For this purpose, the present study has computed separate indexes for operational, financial, and trade indicators (detail is provided in the second table) for the study period (1990-2021) and based on that a composite index is being estimated. The index value is expected to be between zero to one. If the index value is close to zero, then it means the port is performing badly vis-à-vis.

The index is computed for 1990-91 to 2020-21. The study period is divided into four phases based on the major policy initiatives introduced in the port sector: the first phase (1990-91 to 1996-97) represents the pre-reform period in the port sector. The government of India issued the guidelines for private sector participation in the port sector in October 1996 (MoS,2015). This policy changed the landscape of the Indian port sector. This reform transformed the public monopoly of the Indian port sector to private participation. The remaining three phases are the post-reform period (1997-98 to 2020-21): Within this, the second phase (1997-98 to 2003-04) provided a greater impetus for private sector participation. The third phase (2004-05 to 2009-10) flagged the National Maritime Development Programme (NMDP) of 2004 and the last phase (2010-11 to 2020-21) representsthe port sector under the national maritime agenda 2010. The classification of the time period is based on conducting structural breaks for all indicators. The breaks are selected based on the major policy initiatives in the port sector. The structural break analysis confirmed that the breaks are significant for all sets of indicators.

Table 2. Operational, Trade and Financial Performance Indicators

Sl No:	Indicators	Unit	Description and Rationale
1. Operational			
1.1.	Turn Round Time (TRT)	Number of days	The total time spent by the vessel at the port from its arrival at the reporting station till its departure. It consists of navigation time (time for inward and outward movement), pre-berthing detention time, stay at working, shifting time and stay at non-working berths. The indicator gives an idea about the time taken by the vessel in the port which is indirectly related to port efficiency.
1.2	Pre-Berthing Detention Time (PBWT)	Number of days	The time taken by a ship to arrive at the operational berth after reaching the anchorage, excluding the time taken for inward movement. This indicator explains the time for documentation and waiting time because of the unavailability of a berth.
1.3	Inward Movement (IM)	Hours taken	Navigation time taken by a ship for moving from anchorage or reporting station to an operational Jetty/Berth/Mooring.
1.4	Stay at working/non-working berth	Hours taken	The total time spent by a cargo ship at one or more berths in one voyage
1.5	Shifting Time (ST)	Hours taken	The time taken by a ship for moving from one working / non-working Berth/Anchorage to another working / non-working berth/anchorage.
1.6	Outward Movement (OM)	Hours taken	Navigation time taken by a ship from the time of unberthing from the last berth till the vessel reaches reporting station.
1.7	Average Ship Berth-Day Output(AO/SBD)	Tonnes of cargo	The ratio of total cargo handled by vessels sailed to total stay at working berth. It will measure the performance of ports in terms of cargo handling.
1.8	Number of Vessels Sailed (NVS)	Number of vessels	The number of cargo and non-cargo ships that sailed from the port during a specified period. The number of vessels sailed can explain the port choice by

			stakeholders. That is decided by the performance of other indicators. The performance of other indicators also depends on NVS
2. Trade			
2.1	Cargo Handled*	Tonnes of cargo	Total of cargo loaded, cargo unloaded, and the cargo transhipped during a specified period. It explains the total traffic in the port.
3. Financial			
3.1	Operating Income	Rupees per tonne of cargo	Cargo handling and storage charges, Port and Dock charges, Railway earnings and Estate rentals. It explains the financial performance in terms of income of the port as the ratio of total cargo handled.
3.2	Operating Expenditures	Rupees per tonne of cargo	Cargo handling and storage expenditure, expenditure for port and dock facilities for shipping, Railway workings expenditure, expenses on rentable land and buildings and Management and General Administrative Expenses. It explains the financial performance of ports in terms of expenditure as a ratio of total cargo handled.

Source: Manual of Port Statistics, 2015

The present study has selected five variables in the category of operational indicators. The variables are the number of vessels sailed (NVS); average turn round time (ATRT); average pre-berthing detention time (APBDT); percentage of idle time at berth to time at working berth (% IT WB); and output per ship berth day (O/SBD). These indicators are used to study the various aspects of the operational performance of major ports. These include the performance in handling a number of vessels, time taken for ship movement and cargo handling and efficiency in cargo handling. These variables are used to explain the operational performance of major ports in the existing study reports like annual reports of the Ministry of Shipping, basic port statistics and the Ministry's annual reports. All these indicators are ascertained by the audit report of major port trusts (MoS, 1999; 2000; 2002; 2005; 2007; 2008; 2010; 2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018). These are the most preferred indicators for the operational performance as well as efficiency analysis of Indian major ports (Monteiro, 2010; Roy, 2004; Rengamani., et al, 2015; Prakash., et al, 2013; Mandal., et al, 2016: Ghosh., et al, 2001; 2002; De., 2003). Moreover, the turn round time contains three omitted variables, namely, inward movement, outward movement and shifting time. Similarly, a part of the operational indicator of the cargo handled is used as trade indicator. As the trade indicators, we have selected overseas cargo loaded and unloaded as a proxy for the export and import of cargo through the port. In the category of financial indicators, two variables have been selected which are operating income and expenditure. These are variables used by different studies which investigate the financial performance of major ports in India (Monteiro, 2010; Roy, 2004; Ghosh., et al, 2001; 2002; De., 2003).

The data for the study are collected from the Basic Port Statistics Report (various editions) which is an annual publication of the Ministry of Shipping, Government of India.

An index of performance is constructed for each of the three sets of indicators on an annual basis. Then it is averaged for the selected periods. The analysis follows a methodology of constructing an index proposed by Iyengar and Sudarshan (Iyengar and Sudarshan, 1982) which is subsequently followed by UNDP in computing HDI.

Let Xij be the value of i-th performance indicator of j-th port, j=1,2…13 and i=1,..5; for operational indicators and i=1,2 for financial and trade indicators. Then

*Loaded and unloaded overseas cargos are a part of cargo handled and have been taken as trade indicators. These variables are used as a proxy for theexport and import of cargo through the port.

$$Yij = \frac{\text{Xij}-\text{MinXij}}{Max\ Xij - M \quad Xij} \text{---------- (1)}$$

Where, Max Xij and Min Xij are the maximum and minimum of Xij for each year. Yij is the normalised value of selected indicators.

If, however, Xi is negatively associated with port performance like Average Turn Around Time or Operating Expenditure per tonne of cargo, then the above equation can be written as

$$Yij = \frac{Max\ Xij - \text{Xij}}{Max\ Xij - Min\ Xij} \text{---------- (2)}$$

In the next stage, we may construct an index of port performance for each set of indicators as follows:

$Y_j = W_1Y_{1j}+W_2Y_{2j}+\ldots+W_5Y_{5j}$ for operational and

$Y_j = W_1Y_{1j}+W_2Y_{2j}$ for financial and trade indicators.

The weights are calculated by assuming an inverse relation between the variation in the respective indicator and its weight. This approach of weight computation assigns weight based on variations in performance as against equal weight, which is very inclusive of year-to-year changes in performance. More specifically

$$Wi = \frac{\text{k}}{\sqrt{\text{Var (Yi)}}} \text{---------- (3)}$$

Where Wi is the weight for each indicator and $\sum W_i$. 'k' is a constant calculated by taking the inverse of $\sum(1/SD)$ where SD is the standard deviation.

Empirical Evidence on Inter and Intra Port Performance

Approximately, 95 per cent of India's trade by volume is transported through maritime, and the major ports in India contribute significant cargo shares handled through the Indian ports. Since sea transport is the most favoured means of international commodity transport, the performance of major ports will have a significant influence on the trade competence of the country. In this section, we are presenting the performance of major ports in India at a disaggregate level. To begin with, we outline how major ports are performing across three categorisations of indicators. While doing so, we discuss inter and intra-port performance over the study period based on absolute index value and corresponding ranking. This is accompanied by a discussion on changes in performance under different policy phases. Though this provides a snapshot of changes in the performance of each port over the years and in relation to others – it fails to explain which port's performance has shown a promising trend and which port's performance is deteriorating or remaining stagnant. For the purpose based on results, (Table 3,5, 7, 9) we have evaluated performance across indicators under three-fold classification (Table 4, 6, 8, 10).

Operational Performance

Table 3 shows the averaged index of operational performance of major ports along with the corresponding ranks.

Table. 3: Averaged Index of Operational Performance of Major Ports					
Ports	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Kolkata (KDS)	0.3 (12)	0.29 (13)	0.29 (13)	0.34 (13)	0.31 (13)
Haldia (HDC)	0.48 (8)	0.5 (8)	0.36 (11)	0.36 (12)	0.42 (12)
Paradip (PPT)	0.58 (3)	0.52 (7)	0.37 (10)	0.56 (6)	0.51 (6)
Visakhapatnam (VPT)	0.66 (1)	0.63 (3)	0.56 (4)	0.5 (10)	0.58 (3)
Kamarajar (KPL)		0.75 (2)	0.75 (2)	0.63 (5)	0.44 (11)
Chennai (ChPT)	0.5 (6)	0.39 (11)	0.5 (6)	0.66 (2)	0.53 (5)
Tuticorin (VOC)	0.47 (9)	0.39 (12)	0.47 (8)	0.53 (9)	0.47 (10)
Cochin (CoPT)	0.57 (4)	0.54 (5)	0.52 (5)	0.65 (3)	0.58 (2)
New Mangalore (NMPT)	0.46 (10)	0.58 (4)	0.58 (3)	0.64 (4)	0.57 (4)
Mormugao (MoPT)	0.64 (2)	0.54 (6)	0.29 (12)	0.44 (11)	0.48 (8)
JNPT	0.53 (5)	0.75 (1)	0.84 (1)	0.87 (1)	0.73 (1)
Mumbai (MbPT)	0.48 (7)	0.46 (9)	0.5 (7)	0.55 (7)	0.51 (7)
Kandla (KPT)	0.41 (11)	0.44 (10)	0.46 (9)	0.54 (8)	0.47 (9)

Source: Basic port statistics, Various Editions, Authors own calculation
Values inside the parentheses show the corresponding ranks of each port.

Table 4: Evaluation of Operational Performance of Major Ports					
Performance Level	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Better	VPT, MoPT, PPT, CoPT	JNPT, KPL, VPT, NMPT	JNPT, KPL, NMPT, VPT	JNPT, ChPT, CoPT, NMPT	JNPT, CoPT,VPT, NMPT
Average	JNPT, ChPT, MbPT, HDC, VOC	CoPT, MoPT, PPT, HDC, MbPT	CoPT, ChPT, MbPT, VOC, KPT	KPL, PPT, MbPT, KPT, VOC	ChPT, PPT, MbPT,MoPT, KPT,
Poor	NMPT, KPT, KDS	KPT,ChPT, VOC, KDS	PPT, HDC, MoPT, KDS	VPT,MoPT, HDC, KDS	VOC, KPL, HDC, KDS

The operational performance of major ports over the years has shown an improvement for all the ports except for Visakhapatnam, Haldia, Mormugao and Paradip. However, Mormugao and Paradip have shown improvement in operational performance in the last phase. JNPT, Kandla and New Mangalore ports are showing constant improvement in operational performance. All the remaining ports

have shown a decline in the index value in the second phase and then improved for the remaining phases.

During the pre-liberalisation period, the index values of the operational performance of ports at disaggregate levels ranges from 0.31 to 0.66. Visakhapatnam was the best port in operational performance during the pre-liberalisation period with an averaged index of 0.66. The performance of Visakhapatnam was mainly attributed to the small percentage of idle time at berth and having the second-highest output per ship berth day for the period. This was again supported by the better performance in the average pre-berthing detention time and the number of vessels sailed. However, the relative position of Visakhapatnam port in operational performance has continuously declined during the post-liberalisation period from third rank during 1997-98 to 2004-05to ninth rank during 2010-11 to 2020-21 with an index value of 0.63 and 0.56 respectively. This was mainly contributed by the decline in the performance of the same indicators, except for the number of vessels that sailed. Mormugao (0.64) and Paradip (0.58) were the other better-performing ports during the pre-liberalisation period. The best performance in the output per ship berth day is the major contributor to the better performance of Mormugao. Similarly, better performance in percentage of idle time and average pre-berthing detention time are the major contributors to the better performance of Paradip.

JNPT port is the best port in the operational performance for all the periods during post-liberalisation and for the total period with an index value of 0.75, 0.84, 0.87 and 0.73 respectively. The performance in the period 1997-98 to 2004-05 is mainly attributed to the best performance in average turnaround time and percentage of idle time at working berth. During 2005-06 to 2009-10, it was attributed to the best performances in number of vessels sailed, percentage of idle timeat the working berth and second best in average turnaround time. Similarly, for the period 2010-11, the performance is attributed to the best performance in number of vessels sailed, average turnaround time and percentage of idle time at working berth. Following JNPT, Kamarajar (0.75) and Visakhapatnam (0.63) were the other better-performing port during 1997-98 to 2003-04. The performance of Kamarajar was attributed to best performance of in average pre-berthing detention time, average turnaround time and output per ship berth day. At the same time, the performance of Visakhapatnam was attributed to the number of vessels sailed and output per ship berth day. Similarly, Kamarajar (0.75), New Mangalore (0.58),Chennai (0.66) and Cochin (0.65) were the other better-performing ports during 2004-05 to 2009-10 and 2010-11 to 2020-21 respectively. The performance of Kamarajar during 2004-05 to 2009-10 was attributed to the best performance in output per ship berth day, average pre-berthing detention time. Average turnaround time and average pre-berthing detention time are the indicators attributed to the performance of New Mangalore in the same period. During 2010-11 to 2020-21, the best performance in average pre-berthing detention time contributed to the performance of Chennai and for Cochin, it is attributed to the best performance in average turnaround time and better performances in average pre-berthing time and output per ship berth day.

Kolkata was the least performing port in the operational performance for all periods, both pre-liberalisation and post-liberalisation periods with index values of 0.30, 0.29, 0.29, 0.34 and 0.31 for the

total period. This is attributed to the poor performance in output per ship berth day, percentage of idle time at working berth and average turnaround time. Kandla (0.41) and New Mangalore (0.46) were the other poor-performing ports during pre-liberalisation. Average pre-berthing detention time and average turnaround time were the major contributors to the deficient performance of Kandla. For New Mangalore, it was the percentage of idle time at the working berth and the number of vessels sailed. Tuticorin (0.39) and Chennai (0.39); Mormugao (0.29) and Haldia (0.36); and Haldia (0.36) and Mormugao (0.44) were the other poor performing ports for 1997-98 to 2003-04; 2004-05 to 2009-10; and 2010-11 to 2020-21 periods respectively. The poor performance of Tuticorin is attributed to output per ship berth day and percentage of idle time at the working berth. For Chennai, it is attributed to average pre-berthing detention time and average turnaround time. Average turnaround time, number of vessels sailed and average pre-berthing detention time are attributed to the poor performance of Mormugao and for Haldia it was the percentage of idle time at working berth, output per ship berth day and average pre-berthing detention time.

Financial Performance

Table.5: Averaged Index of Financial Performance of Major Ports

Ports	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Kolkata (KDS)	0.41 (8)	0.47 (12)	0.49 (8)	0.49 (7)	0.47 (8)
Haldia (HDC)		0.66 (1)	0.61 (3)	0.52 (3)	0.57 (3)
Paradip (PPT)	0.40 (11)	0.55 (4)	0.59 (4)	0.5 (5)	0.5 (4)
Visakhapatnam (VPT)	0.41 (7)	0.52 (7)	0.54 (6)	0.49 (6)	0.49 (7)
Kamarajar (KPL)		0.58 (3)	0.61 (2)	0.62 (1)	0.61 (1)
Chennai (ChPT)	0.45 (2)	0.49 (10)	0.49 (9)	0.45 (12)	0.47 (10)
Tuticorin (VOC)	0.44 (4)	0.54 (6)	0.57 (5)	0.51 (4)	0.51 (5)
Cochin (CoPT)	0.41 (10)	0.49 (9)	0.45 (13)	0.44 (13)	0.45 (13)
New Mangalore (NMPT)	0.43 (5)	0.54 (5)	0.53 (7)	0.48 (9)	0.49 (6)
Mormugao (MoPT)	0.42 (6)	0.48 (11)	0.48 (10)	0.46 (11)	0.46 (11)
JNPT	0.46 (1)	0.60 (2)	0.68 (1)	0.58 (2)	0.57 (2)
Mumbai (MbPT)	0.41 (9)	0.45 (13)	0.47 (12)	0.47 (10)	0.45 (12)
Kandla (KPT)	0.44 (3)	0.51 (8)	0.47 (11)	0.48 (8)	0.47 (9)

Source: Basic port statistics, Various Editions, Author's own calculation.
Values inside the parentheses show the corresponding ranks of each port.

Table.6: Financial Performance of Major Ports					
Performance Level	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Better	JNPT, ChPT, KPT, VOC	HDC, JNPT, KPL, PPT	JNPT, KPL, HDC, PPT	KPL, JNPT, HDC, VOC	KPL, JNPT, HDC, PPT,
Average	NMPT, MoPT, VPT	NMPT, VOC, VPT, KPT, CoPT	VOC, VPT, NMPT, KDS, ChPT	PPT, VPT, KDS, KPT NMPT	VOC, NMPT, VPT, KDS, KPT
Poor	KDS, MbPT, CoPT, PPT	ChPT, MoPT, KDS, MbPT	MoPT, KPT, MbPT, CoPT	MbPT, MoPT, ChPT, CoPT	ChPT, MoPT, MbPT, CoPT

All major ports, except Haldia, have shown an improvement in financial performance over the years. However, the last phase marked a decline in the index value of all ports except Kolkata, Mumbai, and Kandla. The ports like Paradip, Vishakhapatnam, Chennai, Tuticorin, Mormugao, and JNPT have shown constant improvement till the third phase, and a decline during the last phase. At the same time, ports like Cochin and New Mangalore have shown improvement till the second phase and a decline after that. The financial performance of Kandla Port showed a fluctuating trend over this period.

The financial performance index during pre-liberalisation ranges from 0.44 to 0.51. Chennai was the best port during the pre-liberalisation period with an average index value of 0.51, followed by JNPT(0.51) and Kandla (0.49). Chennai's performance is attributed to better operating expenditure. JNPT was the best-performing port in operating income and Kandla was best in operating expenditure. Similarly, Kamarajar, JNPT and Haldia showed better financial performance during the post-liberalisation period. Haldia (0.66) was the best-performing port for the period 1997-98 to 2003-04 followed by JNPT (0.60) and Kamarajar (0.58). The performances of Haldia and JNPT were attributed to operating income. During 2004-05 to 2009-10, JNPT (0.68) ranked first in financial performance followed by Kamarajar (0.61) and Haldia (0.61). The performance of JNPT and Haldia was attributed to operating income, and for Kamarajar it is attributed to operating expenditure. Likewise, Kamarajar port ranked first in financial performance for the 2010-11 to 2020-21 period and for the total period with index values of 0.61 and 0.61 respectively. JNPT (0.58; 0.61) and Haldia (0.57; 0.57) were the other better-performing ports for the same periods. The reasons for the higher performance of these ports were the same as in the previous period. The performance of Kamarajar during the period is attributed to operating expenditure while the performance of JNPT and Haldia is attributed to operating income.

Paradip was the least-performing port in financial performance during the pre-liberalisation period with an averaged index value of 0.40, which was attributed to operational expenditure. Cochin (0.41) and Mumbai (0.41) ports were the other poor-performing ports during pre-liberalisation. Their poor performance is also attributed to operational expenditure. Mumbai port (0.45) was the least-performing port during 1997-98 to 2003-04 followed by Kolkata (0.47) and Mormugao (0.48). The performance of Mumbai and Kolkata is attributed to operating expenditure and for Mormugao it is attributed to operating income. Similarly, Cochin port was the least-performing port in the financial performance for the other two periods and for the total period with index values of 0.46, 0.45, and 0.45. The performance of Cochin was attributed to the poor performance in operating expenditure for

all these periods. Mumbai (0.47), Kandla (0.48),Chennai (0.45) and Mormugao (0.46) were the other poor-performing ports during 2004-05 to 2009-10 and 2010-11 to 2020-21period. The performance of Mumbai is attributed to operating expenditure and operating income for Kandla. In the case of Chennai and Mormugao, it was attributed to both operating income and expenditure. At the same time, Mumbai (0.47) and Mormugao (0.47) were the other poor-performing ports for the total period. Operating expenditure is attributed to the performance of Mumbai and operating income to the performance of Mormugao.

Trade Performance

Table. 7: Averaged Index of Trade Performance of Major Ports

Ports	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Kolkata (KDS)	0.19 (7)	0.01 (12)	0.06 (12)	0.06 (12)	0.08 (12)
Haldia (HDC)	0.21 (6)	0.33 (7)	0.46 (6)	0.19 (9)	0.26 (9)
Paradip (PPT)	0.12 (8)	0.15 (9)	0.40 (7)	0.48 (3)	0.31 (7)
Visakhapatnam (VPT)	0.51 (5)	0.46 (4)	0.55 (5)	0.39 (5)	0.46 (3)
Kamarajar (KPL)			0.01 (13)	0.04 (13)	0.01 (13)
Chennai (ChPT)	0.56 (2)	0.51 (2)	0.68 (2)	0.47 (4)	0.54 (2)
Tuticorin (VOC)	0.05 (11)	0.08 (11)	0.15 (10)	0.19 (10)	0.12 (10)
Cochin (CoPT)	0.07 (10)	0.11 (10)	0.12 (11)	0.07 (11)	0.09 (11)
New Mangalore (NMPT)		0.30 (8)	0.39 (8)	0.23 (6)	0.28 (8)
Mormugao (MoPT)	0.56 (3)	0.51 (3)	0.55 (4)	0.2 (8)	0.42 (5)
JNPT	0.09 (9)	0.34 (6)	0.61 (3)	0.67 (2)	0.45 (4)
Mumbai (MbPT)	0.57 (1)	0.37 (5)	0.36 (9)	0.21 (7)	0.35 (6)
Kandla (KPT)	0.55 (4)	0.64 (1)	0.69 (1)	0.81 (1)	0.69 (1)

Source: Basic port statistics, Various Editions, Author's calculation
Values in parentheses show the corresponding ranks of each port.

Table. 8: Trade Performance of Major Ports

Performance Level	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Better	MbPT, ChPT, MoPT, KPT	KPT, ChPT, MoPT, VPT	KPT, ChPT, JNPT, MoPT	KPT, JNPT, PPT,ChPT	KPT, ChPT, VPT, JNPT
Average	VPT, HDC, KDS	MbPT, JNPT, HDC, NMPT	VPT, HDC, PPT, NMPT, MbPT	VPT, NMPT, MbPT,MoPT, HDC	MoPT, MbPT, PPT, NMPT,HDC
Poor	PPT, JNPT, CoPT, VOC	PPT, CoPT, VOC, KDS	VOC, CoPT, KDS, KPL	VOC, CoPT, KDS, KPL	VOC, CoPT, KDS, KPL

The trade performance of all the major ports, except Mumbai, improved over the years till the third phase. In the last phase, most of the ports witnessed a large decline in trade performance. Ports like

Kandla, JNPT, Paradip, Tuticorin and Ennore were an exception to this. This decline was majorly contributed by the drop in import cargo at major ports during the year 2020. This also contributed to the trade deficit of the country.

The index of trade performance during the pre-liberalisation period ranges from 0.05 to 0.57 and Mumbai was the best port with an averaged index value of 0.57. Chennai (0.56), Mormugao (0.56) and Kandla (0.55) were the other better performing ports during pre-liberalisation period. The performance of Mumbai is attributed to import cargo and for Chennai and Mormugao it was export cargo. Kandla was the best port in trade performance for all the periods during post-liberalisation. Moreover, the averaged index value of Kandla has also improved constantly during the period from 0.64 during 1997-98 to 2003-04 to 0.69 during 2004-05 to 2009-10 and further into 0.81 during 2010-11 to 2020-21. The performance of Kandla was the best in import cargo.

Similarly, Chennai ranked second in the trade performance during 1997-98 to 2003-04, 2004-05 to 2009-10 and for the total period with index values of 0.51, 0.68 and 0.54 respectively. Export cargo contributed majorly to the performance of Chennai along with good performance in import cargo. During 2010-11 to 2020-21, JNPT (0.68) ranked second, and it is followed by Paradip (0.48). Cargo export contributed to the performance of JNPT, and at the same time import cargo contributed to the performance of Paradip. Mormugao (0.51) and JNPT (0.61) were the other better-performing port for 1997-98 to 2003-04 and 2004-05 to 2010-11 period respectively and this was attributed to cargo export.

Tuticorin (0.05) was the least performing port during the pre-liberalisation period followed by Cochin (0.07) and JNPT (0.09). Both cargo export and import were attributed to the poor performance of all these ports. During 1997-98 to 2003-04, Kolkata ranked last with an index value of 0.01 followed by Tuticorin (0.08) and Cochin (0.11). Both cargo export and import were attributed to the poor performance of all these ports. Kamarajar was the least performing port in trade performance during 2004-05 to 2009-10 and 2010-11 to 2020-21 and for the total period with index values of 0.001, 0.04 and 0.01. And it is also attributed to both cargo export and import. Kolkata (0.06, 0.06, and 0.08) and Cochin (0.12, 0.07 and 0.09) were the other poor-performing ports for the periods mentioned above. Both cargo export and import were attributed to the poor performance of these two ports.

Overall Performance of Major Ports

Table. 9: Overall Performance Index of Major Ports

Port	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Kolkata (KDS)	0.37 (11)	0.36 (12)	0.36 (13)	0.4 (13)	0.38 (12)
Haldia (HDC)	0.09 (12)	0.33 (13)	0.52 (5)	0.45 (10)	0.35 (13)
Paradip (PPT)	0.41 (9)	0.48 (7)	0.5 (8)	0.49 (5)	0.47 (7)
Visakhapatnam (VPT)	0.46 (3)	0.53 (2)	0.55 (2)	0.48 (7)	0.5 (4)

Kamarajar (KPL)		0.52 (3)	0.54 (3)	0.53 (3)	0.53 (2)
Chennai (ChPT)	0.47 (1)	0.47 (8)	0.52 (4)	0.5 (4)	0.49 (5)
Tuticorin (VOC)	0.41 (8)	0.43 (11)	0.47 (9)	0.47 (8)	0.45 (9)
Cochin (CoPT)	0.4 (10)	0.44 (9)	0.41 (12)	0.44 (11)	0.42 (11)
New Mangalore (NMPT)	0.41 (6)	0.51 (4)	0.52 (6)	0.48 (6)	0.48 (6)
Mormugao (MoPT)	0.46 (2)	0.5 (6)	0.44 (11)	0.42 (12)	0.45 (8)
JNPT	0.41 (7)	0.59 (1)	0.7 (1)	0.65 (1)	0.59 (1)
Mumbai (MbPT)	0.43 (5)	0.44 (10)	0.46 (10)	0.45 (9)	0.44 (10)
Kandla (KPT)	0.44 (4)	0.51 (5)	0.51 (7)	0.54 (2)	0.5 (3)

Source: Basic port statistics, Various Editions, Author's calculation
Values in parentheses show the corresponding ranks of each port.

During the pre-liberalisation period, the index of the overall performance of ports ranges from 0.09 to 0.47. Chennai (0.47) was the best-performing port followed by Mormugao (0.46), Visakhapatnam (0.46) and Kandla (0.44). Better performance during the initial years contributes majorly to the rank of Chennai, which was driven by the performance in financial indicators. JNPT ranked first in overall performance during the three periods of post-liberalisation era (with a performance score of 0.59, 0.70 and 0.65 respectively) and during the entire period with an index value of 0.59.The better performance of JNPT is mainly attributed to the performances in all three sets of indicators: operational, financial and trade. Visakhapatnam (0.53, 0.55) and Kamarajar (0.52, 0.54) ranked second and third during 1996-97 to 2003-04 and 2004-05 to 2009-10 period. At the same time, Kandla (0.54) and Kamarajar (0.53), ranked second and third during 2010-21. Kamarajar (0.54), Kandla(0.51), and Visakhapatnam (0.50)were listed as the other better-performing ports for the total period. Haldia (0.09) was the least-performing port for the pre-liberalisation period and the first period during the post-liberalisation. Moreover, Haldia (0.36) is the least-performing port for the total period as well. Kolkata (0.37), Cochin (0.40) and Paradip (0.41) were the other poor-performing ports during pre-liberalisation. Similarly, Kolkata (0.36), Visakhapatnam (0.43), and Mumbai (0.44) were the other poor-performing ports during 1996-97 to 2003-04. During 2003-04 to 2009-10 and 2009-10 to 2016-17, Kolkata ranked last in overall performance with index values of 0.36 and 0.40. It is followed by Cochin (0.41), Mormugao (0.44), and Mumbai (0.46) during 2003-04 to 2009-10 and Mormugao (0.43), Cochin (0.44) and Haldia (0.45) during 2009-10 to 2020-21. Kolkata (0.38), Cochin (0.43), and Tuticorin (0.45) were the poor-performing ports for the total period.

Table. 10: Overall Performance of Major Ports					
Performance Level	1990-91 to 1996-97	1997-98 to 2003-04	2004-05 to 2009-10	2010-11 to 2020-21	Total period
Better	ChPT, MoPT, VPT, KPT	JNPT, VPT, KPL, NMPT	JNPT, VPT, KPL, ChPT	JNPT, KPT, KPL, ChPT	JNPT, KPL, KPT,VPT
Average	MbPT, NMPT, JNPT, VOC	KPT, MoPT, PPT, ChPT, CoPT	HDC, NMPT, KPT, PPT, VOC	PPT,NMPT, VPT, VOC, MbPT	ChPT, NMPT, PPT, MoPT, VOC
Poor	PPT, CoPT, KDS, HDC	MbPT, VOC, KDS, HDC	MbPT, MoPT, CoPT, KDS	HDC, CoPT, MoPT, KDS	MbPT, CoPT, KDS, HDC

Summary

As against the conventional thinking – in this paper, we argue that there exists heterogeneity across ports in terms of their composition and performance. Thus, instead of analysing port performance as a single unit – in this paper, we have tried to locate whether there exist variations in performance across major Indian ports. If so, what explains the same? This is a very important step in empirically establishing the variation in performance across ports and thereby argue in favour of having a more in-depth study at each port level to understand the factors perhaps that explain the same. For this purpose, we have constructed an index across three major performance indicators based on that the overall performance index has also been constructed. The results obtained help us to argue that not all major ports contribute equally. A few ports like JNPT stand out as an outlier in terms of all performance parameters, whereas a few others like Haldia, Kolkata and Cochin ports lag far behind the performance ladder. Across indicators, JNPT and New Mangalore are better in operational performance, whereas Kamarajar and Haldia are better in financials and Kandla and Chennai are better in trade performance.

Over time, the performance of each port (intra-port) has improved significantly but inter-port comparison presents a different picture. JNPT and Kamarajar showed consistency in performance throughout the post-liberalisation period. Whereas all other ports show a fluctuating performance over the years. Poor-performing ports like Chennai and Tuticorin marginally improved their performance. Thus, we argue in favour of having a case-by-case study to understand the problem and prospects of each port – as a first step towards facilitating Indian ports on the global map.

References

Bensassi, S., Márquez-Ramos, L., Martínez-Zarzoso, I., & Suárez-Burguet, C. (2015). Relationship between logistics infrastructure and trade: Evidence from Spanish regional exports. *Transportation Research Part A: Policy and Practice*, *72*, 47–61. https://doi.org/10.1016/j.tra.2014.11.007

De, P., & Ghosh, B. (2003). Causality between performance and Traffic: An investigation with Indian ports. *Maritime Policy & Management*, *30*(1), 5–27. https://doi.org/10.1080/0308883032000051603

Deshmukh, A. (2005). *Indian Ports: Current Scenario* (Working Paper No.14). Department of Economics, Mumbai: University of Mumbai.

Ernst & Young LLP. (2017). East Coast Maritime Summit. In *Port Strategy for India's Next Big Leap in Trade* (Fifth edition). Visakhapatnam.

Gaur, P., Pundir, S., & Sharma, T. (2011). Ports face inadequate capacity, efficiency and competitiveness in a developing country: Case of India. *Maritime Policy & Management*, *38*(3), 293–314. https://doi.org/10.1080/03088839.2011.572700

Ghosh, B., & De, P. (2001). Indian Ports and Globalisation: Grounding Economics in Geography. *Economic and Political Weekly*, 36(34), 3271-3283.

Gaur, P., Pundir, S., & Sharma, T. (2011). Ports face inadequate capacity, efficiency and competitiveness in a developing country: Case of India. *Maritime Policy & Management*, *38*(3), 293–314. https://doi.org/10.1080/03088839.2011.572700

Iyengar, N. S., & Sudarshan, P. (1982). A method of classifying regions from multivariate data. *Economic and Political Weekly*, 2047-2052.

Limao, N., & Venables, A. J. (2001). Infrastructure, geographical disadvantage, transport costs, and trade. *The World Bank Economic Review*, 15(3), 451-479.

Mandal, A., Roychowdhury, S., & Biswas, J. (2016). Performance Analysis of Major Ports in India: A quantitative approach. *International Journal of Business Performance Management*, *17*(3), 345. https://doi.org/10.1504/ijbpm.2016.077250

Monteiro, J. (2010). Measuring Productivity and Efficiency of Major Ports of India. *Economic and Political Weekly*, 45, 325-331.

Ministry of Road Transport and Highways, Manual on Port Statistics: 2015(2015). New Delhi; Transport Research Division Ministry of Road Transport and Highways and Ministry of Shipping, Govt. of India.

Ministry of Road Transport and Highways and Ministry of Shipping, Basic Port Statistics of India 2000-01 (2002). New Delhi; Transport Research Division Ministry of Road Transport and Highways and Ministry of Shipping, Govt. of India.

Ministry of Road Transport and Highways and Ministry of Shipping, Basic Port Statistics of India 2010-11 (2012). New Delhi; Transport Research Division Ministry of Road Transport and Highways and Ministry of Shipping, Govt. Of India.

Ministry of Shipping, Performance Audit of Functioning of Major Port Trust in India 2009-10 (2010). New Delhi; Comptroller and Auditor General of India.

Ministry of Shipping, Basic Port Statistics of India 2009-10 (2011). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping, Basic Port Statistics of India 2010-11 (2012). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping, Basic Port Statistics of India 2011-12 (2013). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping, Basic Port Statistics of India 2012-13 (2014). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping, Basic Port Statistics of India 2013-14 (2015). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping, Basic Port Statistics of India 2014-15 (2016). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping, Basic Port Statistics of India 2015-16 (2017). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping, Basic Port Statistics of India 2016-17 (2018). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping Road Transport and Highways, Basic Port Statistics of India 2001-02 (2003). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping Road Transport and Highways, Basic Port Statistics of India 2002-02 (2004). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping Road Transport and Highways, Basic Port Statistics of India 2003-04 (2005). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping Road Transport and Highways, Basic Port Statistics of India 2004-05 (2006). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping Road Transport and Highways, Basic Port Statistics of India 2005-06 (2007). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping Road Transport and Highways, Basic Port Statistics of India 2006-07 (2008). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Shipping Road Transport and Highways, Basic Port Statistics of India 2007-08 (2009). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Surface Transport, Basic Port Statistics of India 1990-91 (1992). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Surface Transport, Basic Port Statistics of India 1991-92 (1993). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Surface Transport, Basic Port Statistics of India 1992-93 (1995). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Surface Transport, Basic Port Statistics of India 1998-99 (1999). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Ministry of Surface Transport, Basic Port Statistics of India 1999-00 (2000). New Delhi; Transport Research Division, Ministry of Shipping, Govt. of India.

Nordås, H. K., & Piermartini, R. (2004). *Infrastructure and Trade*(WTO Working Papers) doi:10.30875/471105a9-en

Padmasani., & Tamilselvi. K. (2016). An Assessment of Indian Major Seaports Performance and Efficiency. *International Journal of Multidisciplinary Research and Development*, 3(6), 323-327.

Porter, M. E. (1998). Clusters and competition. On competition, 7, 91.

Prakash, N. B., Rao, B. R., & Anupama, T. (2013). Major Ports of India. *The Indian Economic Journal*, 60(4), 163-172. doi:10.1177/0019466220130409

Rajasekar, T., & Deo, M. (2012). The Size Effect of Indian Major Ports on its Efficiency Using Dea-Additive Models. *International Journal of Advances in Management and Economics*, 1(5), 12-18.

Rengamani, J., & Venkatraman, V. (2015). A Study on the Performance of Major Ports in India. *International Journal of Management*, 6(10), 48-55.

Managing port reforms in India: case study of Jawaharlal Nehru Port Trust (JNPT) Mumbai (English). World Development Report background papers; 2005 Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/208571468749990847/Managing-port-reforms-in-India-case-study-of-Jawaharlal-Nehru-Port-Trust-JNPT-Mumbai

Appendix 1

Weights of Operational Indicators					
	W1(NVS)	W2(ATRT)	W3(APBDT)	W4(ITWB)	W5(OSBD)
1990-91	0.224	0.200	0.198	0.151	0.227
1991-92	0.205	0.219	0.222	0.156	0.199
1992-93	0.213	0.203	0.225	0.158	0.200
1993-94	0.213	0.222	0.191	0.185	0.189
1994-95	0.205	0.205	0.204	0.190	0.197
1995-96	0.208	0.231	0.225	0.187	0.149
1996-97	0.219	0.197	0.214	0.187	0.183
1997-98	0.200	0.191	0.220	0.188	0.201
1998-99	0.215	0.191	0.202	0.203	0.189
1999-00	0.209	0.203	0.183	0.215	0.190
2000-01	0.178	0.217	0.221	0.217	0.167
2001-02	0.192	0.200	0.214	0.198	0.195
2002-03	0.178	0.194	0.221	0.185	0.222
2003-04	0.196	0.178	0.195	0.201	0.230
2004-05	0.174	0.202	0.215	0.185	0.224
2005-06	0.177	0.210	0.186	0.202	0.224
2006-07	0.195	0.206	0.186	0.190	0.224
2006-07	0.202	0.182	0.167	0.216	0.233
2008-09	0.189	0.194	0.195	0.212	0.210
2009-10	0.200	0.175	0.200	0.232	0.193
2010-11	0.202	0.211	0.182	0.203	0.202
2011-12	0.195	0.187	0.161	0.227	0.230
2012-13	0.181	0.204	0.216	0.187	0.211
2013-14	0.191	0.209	0.192	0.212	0.196
2014-15	0.202	0.205	0.201	0.192	0.199
2015-16	0.184	0.195	0.202	0.214	0.204
2016-17	0.214	0.193	0.177	0.190	0.226
2017-18	0.191	0.184	0.206	0.198	0.221
2018-19	0.199	0.197	0.196	0.185	0.223
2019-20	0.216	0.205	0.205	0.160	0.214
2020-21	0.218	0.215	0.183	0.183	0.201

Appendix 2

Weights of Trade and Financial Indicators				
	W1(Import)	W2(export)	W1(Op Income)	W2(Op Expenditure)
1990-91	0.463	0.537	0.496	0.504
1991-92	0.460	0.540	0.511	0.489
1992-93	0.444	0.556	0.514	0.486
1993-94	0.437	0.563	0.185	0.181
1994-95	0.448	0.552	0.523	0.477
1995-96	0.452	0.548	0.499	0.501
1996-97	0.461	0.539	0.503	0.497
1997-98	0.490	0.510	0.508	0.492
1998-99	0.503	0.497	0.460	0.540
1999-00	0.509	0.491	0.486	0.514
2000-01	0.510	0.490	0.520	0.480
2001-02	0.499	0.501	0.471	0.529
2002-03	0.521	0.479	0.500	0.500
2003-04	0.507	0.493	0.487	0.513
2004-05	0.509	0.491	0.460	0.540
2005-06	0.492	0.508	0.506	0.494
2006-07	0.501	0.499	0.465	0.535
2006-07	0.546	0.454	0.570	0.430
2008-09	0.525	0.475	0.489	0.511
2009-10	0.515	0.485	0.496	0.504
2010-11	0.507	0.493	0.495	0.505
2011-12	0.531	0.469	0.498	0.502
2012-13	0.525	0.475	0.508	0.492
2013-14	0.524	0.476	0.475	0.525
2014-15	0.536	0.464	0.466	0.534
2015-16	0.523	0.477	0.499	0.501
2016-17	0.545	0.455	0.487	0.513
2017-18	0.524	0.476	0.492	0.508
2018-19	0.519	0.481	0.511	0.489
2019-20	0.553	0.447	0.501	0.499
2020-21	0.544	0.456	0.500	0.500

Appendix 3

Weights of Overall Performance			
	W1 (Operational)	W2 (Financial)	W3 (Trade)
1990-91	0.112	0.829	0.059
1991-92	0.184	0.723	0.093
1992-93	0.215	0.688	0.097
1993-94	0.089	0.872	0.039
1994-95	0.280	0.580	0.140
1995-96	0.194	0.720	0.086
1996-97	0.154	0.772	0.074
1997-98	0.225	0.672	0.104
1998-99	0.280	0.558	0.162
1999-00	0.148	0.715	0.137
2000-01	0.239	0.587	0.174
2001-02	0.233	0.608	0.159
2002-03	0.215	0.644	0.141
2003-04	0.265	0.530	0.205
2004-05	0.284	0.526	0.190
2005-06	0.221	0.639	0.140
2006-07	0.276	0.541	0.182
2006-07	0.297	0.506	0.197
2008-09	0.251	0.570	0.179
2009-10	0.196	0.625	0.178
2010-11	0.207	0.618	0.175
2011-12	0.204	0.656	0.140
2012-13	0.256	0.595	0.148
2013-14	0.268	0.564	0.168
2014-15	0.244	0.585	0.170
2015-16	0.256	0.594	0.150
2016-17	0.214	0.640	0.146
2017-18	0.250	0.607	0.143
2018-19	0.236	0.628	0.135
2019-20	0.076	0.878	0.046
2020-21	0.051	0.913	0.036

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