Transportation Research Part A 86 (2016) 56–77

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

When it comes to container port efficiency, are all developing regions equal?

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ARTICLE INFO

Article history:
Received 4 December 2014
Received in revised form 19 October 2015
Accepted 4 January 2016

Keywords:
Port productivity
Port efficiency
Developing regions
Benchmarking
Stochastic frontier analysis

ABSTRACT

In this paper we carry out a container port performance analysis of the developing world between 2000 and 2010, using both parametric and nonparametric approaches. From a unique dataset – our sample covers 70 developing countries, 203 ports, and 1750 data points–, we examine the evolution and drivers of productivity and efficiency changes across developing regions. We show that productivity growth rates between 2000 and 2010 vary significantly and that this heterogeneity is explained by pure efficiency changes rather than scale efficiency of technological changes. Therefore, we carry out a detailed efficiency analysis to determine the drivers of port efficiency. Time series results show an upward trend for port efficiency in developing regions, as it increased from 51 percent in 2000 to 61 percent in 2010. Our analysis indicates that private sector participation, the reduction of corruption in the public sector, improvements in liner connectivity and the existence of multimodal links increase the level of port efficiency in developing regions.

1. Introduction

About 80 percent of world trade is carried via maritime transport and consequently the performance of ports, being the most important gateways for international trade, is a key determinant of countries' competitiveness. Assessments of the level and evolution of port performance, if able to influence the adoption of public policies, can bring about sizable reductions in logistics costs. The need to reduce logistics costs is more acute in developing countries which as a group show a significant cost gap when compared to OECD countries. According to the World Bank's Logistics Performance Indicators (World Bank, 2014a) developing countries scored 2.41 in 2014 on a scale from 1 to 5, compared to 3.70 in OECD countries.

The last decades have witnessed a radical transformation of the shipping market with the emergence of the container as increasingly important transportation equipment. Even though containerized commercial services date from the 1950s, containerization only started to seriously affect global trade patterns and manufacturing strategies in the 1990s (Rodrigue, 2013). The changes have been so profound that by 2009, over 90 percent of nonbulk maritime trade was shipped in containers across the world, shaping international trade among countries in all regions (Ebeling, 2009). In recent years, developing countries have increased their role in the container maritime shipping market. These countries moved 35.7 percent of the world's container traffic in 2000 while ten years after their share reached 47.5 percent, despite accounting for 29 percent

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http://dx.doi.org/10.1016/j.tra.2016.01.018
0965-8564/

of the gross world product (World Bank, 2014b). This growth was the result of deeper integration of supply chains, a notable increase in commodities trade, and higher volumes of import demand for capital and consumer goods. Although most of this expansion is a product of fast development in larger developing countries, such as China, India, Russia, and Brazil, small and medium-sized developing economies experienced a similar expansion. As an example, from 2000 to 2010, container traffic growth rates in Bangladesh and Peru were 197 percent and 233 percent, respectively, rates that rival those of China (217 percent) and Brazil (237 percent).

The impressive growth of container traffic handling in ports in developing countries coexisted with a large gap in the perception of port quality between developed and developing countries. According to the port quality perception indicator prepared by the World Economic Forum (2014), developed countries outperform developing countries by 5.5–3.7 on a scale from 1 to 7 based on a country average comparison, with Singapore (6.8) and Hong Kong (6.6) as the top performers.

The evidence shows a strong negative link between port efficiency and transport costs. In Latin America, Wilmsmeier et al. (2006) calculates that doubling port efficiency in a pair of ports has the same impact on international transport costs as halving the distance between them. Similarly, Clark et al. (2000) found that improving port efficiency from the 25th to 75th percentile reduces shipping costs by 12 percent in this region. When it comes to shipping costs, the World Bank' Doing Business report (2013) shows much higher exports costs per container in developing regions: USD1283 in Latin America; USD1787 in South Asia and USD2108 in Sub-Saharan Africa, compared to USD1070 in OECD high income countries (World Bank, 2013). The cost comparison is similar for imports with values of USD1676, USD1968, USD2793 and USD1090, respectively. Although we may find the reasons on the existence of trade barriers or the lack of good trade facilitation (UNCTAD, 2003; Hoekman and Nicita, 2011; World Bank, 2011), it is reasonable to assume that one port performance is also a likely candidate to partially explain the observed cost differential.

Considering both the impressive traffic growth and the higher costs associated to ports in developing regions – together with the perception of a lower service quality, the little knowledge available on the port performance in the developing world is surprising. The adoption of cost-effective policies aimed at improving port competitiveness requires good quality information in the form of benchmarks of performance indicators. Unfortunately, there are very limited comprehensive studies of the productivity and efficiency of container ports in developing countries, and what little is available is focused mostly on single countries or small geographic regions.

Relying on a unique dataset that covers the entire developing world between 2000 and 2010, this paper calculates the drivers of productivity changes among developing regions and identifies determinants of port efficiency. To the best of our knowledge, there is no study that analyzes the level of port performance, their differences and potential determinants across all the developing regions.

This paper first looks briefly at port performance theory, including efficiency and productivity analyses. It then presents the available data and provides a detailed review of descriptive statistics by region, before turning to an examination of the productivity of container terminals in developing regions. The sources of differences in productivity between regions are then examined and an efficiency analysis is conducted. Finally, the paper puts forth some conclusions and policy recommendations.

2. Benchmarking port performance

Several port performance indicators have been used with the aim of improving port operations and providing useful information for port development planning and strategy. Talley (2006) defines these indicators as choice variables – i.e., variables that can be controlled by port management – for optimizing economic objectives. These indicators may assess port operations from different viewpoints (UNCTAD, 1976). Some examples of the broad taxonomy used to measure performance include efficiency, productivity, utilization, and effectiveness indicators.

The port industry has mostly relied on the use of partial performance indicators because these metrics are simple to understand and easy to calculate.[1] These indicators describe waiting times, service or turnaround time, labor expenditure, capital equipment expenditures per ton of cargo, tons/TEUs[2] per ship hour in port or at berth, berth occupancy, and cargo handling revenues per ton of cargo, among other industry metrics. However, a port production function requires from multiple outputs and inputs. For this reason, the economic literature has evolved and increasingly focuses on total measures of port performance, that account for a mix of inputs used, technology to transform inputs into outputs, and the firm's productive scale. In this field, two different concepts stand out: efficiency and productivity.

2.1. Port efficiency

Efficiency has been addressed by port-related literature from many different perspectives. Essentially, port efficiency analyzes established relationships between inputs (mainly a port's physical facilities and its labor force) and outputs (such as quantities or movements in ports). To that purpose, it is necessary to estimate a production or cost frontier – i.e., the set

[1] Partial performance indicators have been in use in the port industry for more than four decades. UNCTAD (1976) is the first in the literature that summarizes and explains partial performance indicators in the port sector.

[2] The TEU – twenty-foot equivalent unit – is a unit of cargo capacity of containers based on the volume of a 20-foot-long intermodal container.