Chapter 13

Analysis and Forecasting of Port Logistics Using TEI@I Methodology

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ABSTRACT

In this chapter, the authors propose an integrated forecasting model based on the TEI@I methodology for port logistics forecasting. This model analyzes the port logistics time series data and other information several steps. In the first step, several econometric models are built to forecast the linear segment of port logistics time series. In the second step, a radial basis function neural network is developed to predict the non-linear segment of the time series. In the third step, the event-study method and expert system techniques are applied to evaluate the effects economic and other events that may impact port logistics. In the final step, synthetic forecasting results are obtained based on the integration of the predictions from first three steps. For illustration, Hong Kong port’ container throughout series is used for a case study. The empirical results show the effectiveness of the TEI@I integrated model for port logistics forecasting.

INTRODUCTION

Port logistics plays a pivot role in the world’s rapid growth of international trade and regional economic (Song, 2002; Chou, 2002). For example, port logistics and related down-stream activities account for no less than 25% of Hong Kong’s GDP and nearly 25% of its workforce. More than 85% of the trade cargo in Hong Kong is transported through port (C&SD, Hong Kong SAR, 2008). Port logistics oc-
cupies a central position in the overall world-wide logistics system not only because the amount of cargos that goes through various ports is more than any other transportation modes, but also because it connects land transportation and waterway shipping and provides a hub for information on cargo resources, technologies and services to merge. Port logistics service involves many different players - cargo suppliers, clients, port terminal operators, shipping companies and participants of other parties. The cargo volume of a port is basically determined by its supply capacity and demand condition, and is also strongly influenced by many other factors, such as irregular past/present/future events like weather, geographical environment, nature environment, GDP growth, regional economic structure, political aspect and management and service level etc. Moreover, there may be competing ports that serve the same hinterland so that the cargo flow can be uncertain. These facts lead to a strongly fluctuating and interacting port logistics market environment and the fundamental mechanism governing the complex dynamic is difficult to understand. In addition, as changes of port cargo volumes have a strong impact on the regional economic situation and especially the investment policy of terminal operators and shipping companies (Seabrooke et al, 2003), the development trend of port’s cargo volumes is of great interest to researchers and institutions. Hence, port cargo forecasting is a very important research topic, although it is an extremely hard one due to its intrinsic complexities. Changes in port’s cargo volumes may have a potential and significant effect on the regional economy and market players. The reasons are mainly two-folds. On one hand, it is obvious that the sharp increase in port’s cargo volumes in the coming years should undoubtedly accelerate the economic growth, and terminal operators and shipping companies may need to expand their investment to (at least) maintain their market positions and achieve higher profits. On the other hand, the slow and even negative growth of port’s cargo volumes in the future may drive terminal operators and shipping companies to make a conservative investment policy for the reduction of their operating cost, and may adversely affect the regional economic growth.

In term of port’s cargo volume forecasting, the existing literature mainly focuses on qualitative analysis of the developments and factors that affect port cargo flows (Cheng & Wong, 1997; Lee, 2001; Ngai and Lin, 1997; Seabrooke et al, 2003; Cullinane et al, 2004). The literatures on quantitative port’s cargo volume forecasting are very limited. Early port forecasting research usually applies regression analysis and time series analysis methods to forecast annual port’s container throughput data, Klein and Verbeke (1986) used Box-Jenkins method with transfer function to predict Antwerp port’s cargo throughput in 1980s. De-Gooijer and Klein (1989) applied single variable and multiple variables time series models to predict Antwerp port’s cargo throughput. Klein (1996) imported data transform and interpolation methods for improving de-Gooijer and Klein (1989)’s model. The quality of the forecasts based on these methods is not adequate, with the absolute percent error around 10% (Lam et al, 2004). In recent years, port’s cargo volume forecasting researches usually adopted error correction model, neural network technique and nonparametric regression method. Fung (2002) developed a triangle-oligarch game model for discussing the competition relation among Hong Kong terminals container throughput, Hong Kong midstream container throughput and Singapore port container throughput. The results show that different business types (Hong Kong midstream business and Hong Kong terminals business) and different ports (Hong Kong port and Singapore port) exhibit strong substitutability. Based on the game model, Fung (2002) used error correction model for predicting Hong Kong port’s container throughput, and reported that the growth of Shenzhen port throughput offers an opportunity for Hong Kong port in future, and serves to attract