CHINESE INVESTMENT IN OVERSEAS CONTAINER TERMINALS: THE ROLE OF INVESTOR ATTRIBUTES IN ACHIEVING A HIGHER PORT COMPETITIVENESS

LU LI

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The Hong Kong Polytechnic University

Department of Logistics and Maritime Studies

Chinese Investment in Overseas Container Terminals: The Role of Investor Attributes in Achieving a Higher Port Competitiveness

Lu Li

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CERTIFICATE OF ORIGINALITY

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Abstract

Chinese companies have invested in over 100 overseasports during the last two decades, but their contribution to the competitiveness of local terminals remains unknown. In contrast to previous qualitative geopolitical interpretations of China-labeled port projects, this study empirically examines how investor characteristics associated with China affect the throughput evolution and market shares of the individual container terminals. The key focus is on terminal performance to neutralize the influence of non-Chinese investors in focal ports with several terminals. Panel data from 2008 to 2019 are analyzed using pooled regression for 68 overseas container terminals operated by three Chinese international port operators (COSCO Shipping Ports, China Merchants Holdings International, and Hutchison Ports). The regression results indicate that the focal container terminal's market share would gain from being a state-owned firm, owning a vessel fleet, and having a greater stake in the project. On the other hand, shareholder complexity may have a detrimental effect on the terminal's competitiveness. An intriguing finding is that investments in politically insecure areas with fewer regional ports are more likely to result in increased market share for state-owned firms. These findings have management implications for businesses and add to the body of knowledge on foreign port investment.

Publications Arising from the Thesis

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Table of Contents

List of Figures

List of Tables

Chapter 1

Introduction

The first chapter primarily introduces the study's background and objectives. It begins with a brief introduction on the history, the major players, and, most recently, the research focus and discussions on Chinese enterprises' participation in foreign countries' ports. By highlighting three shortcomings of previous research, this chapter establishes three research objectives and elaborates on the research scope, sample size, and thesis structure.

1.1. Background

Over the last two decades, China has unleashed an unparalleled flood of investment in international transportation and logistics infrastructure projects. Until 2019, Chinese firms had constructed, invested in, or operated more than 100 foreign ports in part or entirely (Liu et al., 2020). China's unprecedented foreign port infrastructure investment spree has generated a plethora of interpretations and contradictory perspectives in academics and the business press, with most debates concentrating on the investment aims, modes of operation, benefits, and risks (Chen et al., 2016; Fei, 2019; Mourao, 2018). The debate on the significance of Chinese port investments to the competitiveness of focal ports continues to be unresolved, partially

because three factors prohibit us from gaining a more comprehensive, fair, and unbiased understanding of such investments.

To begin, the majority of the empirical literature is regionally focused (Devermont et al., 2019; Yang et al., 2020). Qualitative research and newspaper articles frequently concentrate on a few extremely successful or highly contentious Chinese port investment projects (Liu et al., 2020). For example, the Chinese official media promoted the Port of Piraeus investment project as a success story (The myth of the port of Piraeus, 2021), owing to the Chinese investor COSCO Shipping's successful contribution to the port's rise from 93 to 26 in the "Top 100" container terminals in terms of throughput (Lloyd's list, 2020). Iftikhar and Zhan (2020) demonstrated the importance of China's economic aims in overseas port investment through a comparison of the China-branded, high-performing Piraeus port project in Greece with the underperforming Gwadar port project in Pakistan. Liu et al. (2020) conducted case studies of Pakistan's Gwadar Port and Malaysia's Kuantan Port to debunk the myths surrounding the port investment objectives of large and small Chinese state-owned businesses (SOEs). In Kavirathna et al. (2021)'s comparison of China Merchant Holdings' investment in Colombo Port and Hambantota Port in Sri Lanka, the former was shown to have a higher port efficiency and a greater market share. Yang et al. (2020) examined 20 Chinese SOE-invested African port projects and concluded that Chinese investments are critical to the realization of major port development and rehabilitation projects across Africa. According to De Soyres et al. (2020), Belt and Road Initiative (BRI)-related transportation projects enhanced economic welfare by 2.8% along the Belt and Road. In summary, existing research and news coverage are region-specific, limited to a few examples, and occasionally anecdotal in character. There is a need for a comprehensive worldwide examination of Chinese port investments overseas that is based on a rigorous research design.

Second, China-branded port projects have been initiated by a variety of Chinese players with differing corporate ownership, company expertise, transnational business experience, and location selection and entry preferences. Researchers have explored the interaction between institutional (Xiao and Lam, 2020; Panayides et al., 2015), political (Chen et al., 2021; Liu et al., 2017), and project-related factors (Parola et al., 2013; Yang et al., 2020) and their impact on port competitiveness. Nonetheless, few studies have examined the role of investor characteristics. Additionally, stakeholders' perceptions of a high-performing terminal in

greenfield and brownfield port developments vary. Due to the lack of a globally accepted standard for a good port project, the study will examine different indicators from academia and industry and suggest a quantitatively measurable indicator that is widely accepted and relevant. Multiple dummy variables have been constructed in the past to assess a greenfield project's attractiveness to private investors, including contractual arrangements (Notteboom et al., 2012), entry modalities for terminal operators (Parola et al., 2013), and the private sector's investment amount and duration (Panayides et al., 2015). When a port is completed and operational, establishing a strong regional market position is commonly acknowledged as a primary objective of port investment programs (Wiegmans et al., 2002; Olivier, 2010; Notteboom et al., 2012). Given that the majority of Chinese firms joined the international port market via terminal purchase, joint venture, or minority or majority ownership in an existing terminal facility (Yang et al., 2020), this study will focus exclusively on Chinese entry into existing terminal facilities.

However, many larger ports are home to multiple terminals operated by different Chinese or international operators. If a port-level focus is adopted, non-Chinese investments may hide the actual contribution of Chinese enterprises to the competitiveness of the port. As a result, while analyzing the success of a Chinese port investment in an overseas port, the data collecting, and analysis procedure must be terminal-level focused.

1.2. Research Objectives

Given that Chinese corporations have invested in overseas port projects for years and amassed substantial data, this research intends to complement existing work by conducting a comprehensive and quantitative assessment of Chinese firms' investment effect on foreign port projects on a worldwide scale. Unlike earlier research, this one focuses on the effect of investor characteristics on container terminal project performance, while also incorporating a set of control factors culled from the existing literature. The research focuses on data and output at the terminal level for the Chinese entry into existing terminal facilities, complementing previous research by ignoring the impact of non-Chinese terminals on port competitiveness. This study focuses on three research objectives:

- A comprehensive screening of port terminal project competitiveness indicators and investor attributes with new characteristics.
- A time-tracked assessment of the investor attributes' impacts on terminal-level competitiveness.
- Practical implications for Chinese enterprises.

1.3. Research Scope

The empirical part of this study is based on panel data of 68 overseas container terminals from 2008 to 2019 of three Chinese global port operators (COSCO Shipping Ports, China Merchants Holdings International, and Hutchison Ports). The study is organized in the following manner. Chapter 2 conducts a study of the literature on the definition, evaluation methodology, and factors affecting port investment competitiveness. The methodology and research strategy are discussed in Chapter 3, while Chapter 4 includes empirical research on a wide sample of Chinese-invested terminals. Chapter 5, which precedes the conclusion section, discusses management implications.

Chapter 2

Literature Review

The second chapter conducts a comprehensive review of the definition, pertinent parameters, and methodology for port project competitiveness that have been documented in the previous literature and serve as the study's pool of alternatives. Then this chapter summarizes the final selection by addressing the advantages and disadvantages of various variables and approach choices.

2.1. The Definition of Port Project Competitiveness

Port projects are often somewhat complex in terms of the aims of participants and the division of rights and obligations. Scholars, legislators, and industry professionals have developed a variety of taxonomies to quantify port performance/competitiveness, which includes but are not limited to port throughput, market share, efficiency, and financial performance. A port or terminal project is considered competitive if it matches the owner's (strategic) objectives and the expectations of stakeholders such as port customers and public authorities. Their primary

objectives may include customer satisfaction, port/terminal efficiency, financial performance, socioeconomic effect, port connection, and/or overall port competitiveness. Transport researchers adapted the economic notion of customer satisfaction to assess port performance (e.g., service fulfillment and service costs) (Brooks, 2006; Brooks and Schellinck, 2013). For instance, Cheng et al. (2020) evaluated port customers' subjective utility to quantify the effects of port investment. The Service Quality Modal (SERVQUAL) has also been utilized in academic research to assess the quality of port services (see, e.g., Ugboma et al., 2007). Typical academic measures of port efficiency include data development analysis (DEA) (Tongzon, 2001; Schyen and Odeck, 2013; Zarbi et al., 2019) and stochastic frontier analysis (SFA) (Notteboom et al., 2000; Huang, 2018; Wiegmans and Witte, 2017), while partial terminal productivity is frequently used in practice. The financial performance of a port project can be evaluated using a variety of financial indicators (return on investment, operating margin, earnings before interest, taxes, and amortization, among others) and appropriate business valuation methods. There are three types of evaluations: (1) asset-based valuations, which value a business based on its total net assets; (2) income-based valuations, which value an entity based on its earning capability/potential; and (3) cash flow-based valuations, which typically use the discounted cash flow method (DCF) (Fraser et al., 2021). Employment creation and value-added are frequently used socioeconomic impact indicators to demonstrate a port project's economic benefit to local communities and various levels of government. Other indications of socioeconomic impact include generated fiscal revenues (i.e., flow-back to a country's or region's Treasury), realized public and private sector investment, and the port project's contribution to lowering a region's logistics costs and facilitating international trade. Enhancing the port's network connectivity on the seaside or the landside is another aspect of a port's performance. Advances in a port's connection can be quantified using geographic network metrics (e.g., betweenness centrality and maritime degree; see Ducruet and Notteboom, 2012) or a composite connectivity metric such as UNCTAD's Liner Shipping Connectivity Index (UNCTAD, 2021).

One of the most often cited indices of port competitiveness is physical output or maritime cargo throughput, which is a direct indicator of cargo movement between the economic hinterland and international markets. The data availability for this indicator is high, as most ports publish extensive information on their maritime traffic on a yearly, quarterly, or monthly

basis. It is also one of the least contentious port performance metrics in terms of methodology and benchmarking, as seen by the numerous port rankings produced by port groups, international organizations, and consulting firms. Additionally, maritime traffic data and projections are critical components of port project appraisal and strategic port planning exercises (Parola et al., 2021). Port competitiveness in the face of regional competition is also determined by the port's regional market share based on maritime cargo throughput. For example, Panayides et al. (2015) used a dummy variable to determine if a port's throughput is among the top 20% in the local region or not.

After examining the numerous metrics that various stakeholders can use to assess a port project's competitiveness and data availability, this study defines it from the perspective of the public authority, focusing on the impact of Chinese investment on port competitiveness as measured by increases in container throughput and the associated market share generated by the terminal project.

2.2. Relevant Factors of Port Project Competitiveness

According to available literature and port business reports, port competitiveness is influenced by institutional, project-specific, and facility user factors. Various researchers refer to institutional or transnational characteristics, owing to the breadth of Chinese firms' global project investments. Zhang (2014) found that the host country's economic, political, and cultural concerns will affect the viability and profitability of overseas port developments. Aerts et al. (2014) identified a cluster of critical success factors (CFSs) in port Public-Private Partnership (PPP) projects, comprising economic, financial, legal, political, procedural, social, structural, and technical features, based on extensive literature analysis. Through a three-stage qualitative research technique and questionnaire survey, they discovered eight dominating CFSs to be superior in port PPP projects[1]. Chen et al. (2021) evaluated the influence of

[1] The eight CFS include the concreteness and preciseness of the concession agreement, the ability to

bilateral diplomatic operations between China and the host country on port project location selection using institutional theory. Additionally, project-specific characteristics were examined. Fei (2017) used a DEA model to compare port efficiency following investment under various entrance types. Cheon et al. (2010) generated panel data on port ownership, corporate structure, and port inputs and outputs for 98 of the world's largest ports to examine the influence of institutional reforms on port efficiency. According to Parola et al. (2013), the size of the project (annual design capacity in TEU) and the number of partners affect the foreign entry tactics of terminal operators. Tongzon and Heng (2005) identified eight critical variables of port privatization, efficiency, and competitiveness. Unlike prior studies, Cheng et al. (2020) developed a method for analyzing the dynamic change in consumers' port preferences following a port's competitiveness improvement. Xiao and Lam (2020) were pioneers in investigating the differences in the willingness to take public-private-partnership contractual risk among private port investors with a focus on the mediating impacts of business friendliness and freedom from governmental intervention. They then extended the study by empirically testing the effect of project-specific government actions (project initiation, free requirement, direct government investment) on the attractiveness of port public-private-partnership projects (Xiao and Lam, 2022). Few empirical research examines investor characteristics. Yang et al. (2020) identified 17 critical investor characteristics, including financial competence and experience in international investment projects. They consulted experienced specialists to assess several Chinese investors on each criterion, but their conclusions were subjective.

In summary, the empirical evidence demonstrates the effects of institutional, economic, and project-specific characteristics on port competitiveness, with few considering the impacts of investor attributes. The following chapter will develop quantitative investor attribute measures based on previous research.

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allocate and share risk appropriately, the technical feasibility of the project, the commitment made by partners, the attractiveness of the financial package, a clear definition of responsibilities, the presence of a robust private consortium and a realistic cost/benefit assessment.

Chapter 3

Methodology and Hypotheses

This chapter discusses the methods used and the overall design of the research. To begin, it discusses five current hypotheses about investor characteristics and port competitiveness based on the available literature. Following that, explanatory variables and many control variables are generated following the aforementioned assumptions (i.e., project-specific, governance, doing-business, and country-specific variables). Finally, the chapter offers a model for evaluating the hypotheses using panel data regression.

3.1. Hypotheses

The selection of investor and control attributes is based on a thorough review of the literature on port competitiveness and port investor-related business reports (e.g., Drewry report series and company news releases) and was cross-checked during a handful of unstructured interviews with maritime experts from academia and industry in the first half of 2021.

Corporate ownership is a distinctive investor characteristic. Chinese state-owned enterprises (SOEs) are critical to China's national economy (Du and Zhang, 2018). China COSCO

Shipping Group (COSCO Shipping), the country's largest shipping corporation, and China Merchant Holdings International, based in Hong Kong, are two examples (CMHI). Over 40% of international port projects have been directed by SOEs. In the container terminal industry, only two non-SOEs are active: Hutchison Ports (previously Hutchison Port Holdings (HPH), a Hong Kong-based private firm formed in 1866) and Shandong Province's Landbridge Group. According to Yu (2014), SOEs have stronger ties to the government, a larger responsibility for social welfare, and are subject to "soft budget limits." The Belt and Road Initiative (BRI), launched in 2013, laid the groundwork for robust bilateral diplomatic relations between China and other countries and established a more stable and predictable institutional environment for SOEs' foreign investments (Chen et al., 2021). As a result of these advantages, SOEs may outperform private firms in the host country.

H_1: Chinese enterprises which are SOEs will positively affect the port's competitiveness.

Chinese investors specialize in a variety of industries, including port operations, international shipping, building, and finance (Chen et al., 2019). Shipping lines are direct users of ports. From the standpoint of the global supply chain, shipping companies can integrate the overseas port into their worldwide shipping network, thereby increasing cargo flows and shipping demand in the local area. Chinese container terminal operators that own or operate a vessel fleet (like COSCO Shipping) are expected to contribute positively to port competitiveness.

H_2: Chinese enterprises which own and operate a vessel fleet will positively affect the port's competitiveness.

Chinese investors have varying levels of familiarity with port operations and management. For instance, in the early 1990s, HPH acquired the Felixstowe Port in the United Kingdom (Hutchison Ports Brochure, 2020). COSCO Shipping was a 1997 participant in the United States' Long Beach and Los Angeles port lease projects (Chen et al., 2019). In 2010, CMHI made its first port investment in the United States (Chen et al., 2019). Parola et al. (2013) quantified port investment experiences by examining the number of years and abroad subsidiaries that a firm owned in the same cultural cluster. However, over the last two decades, the investment momentum of Chinese enterprises has shifted. The BRI has pushed SOEs to aggressively expand their overseas port network in comparison to private firms. In this regard,

neither the port investment history of Chinese investors nor the overall number of offshore terminals can accurately reflect their port operation experience. Henderson (1984) demonstrated a favorable correlation between experience and the efficiency benefits associated with the investment. The regular presence of Chinese investors in international port investment projects encourages technical and commercial competence in terminal operations and management, which is important for terminal efficiency improvement. As a result, this chapter suggests the following hypothesis using terminal capacity utilization as a proxy for Chinese investors' port investment experience.

H_3: Chinese enterprises' overseas port investment and management experience will positively affect the port's competitiveness.

According to the principal-agent theory, port stakeholders have divergent opinions on who owns the port infrastructure (Dewatripont and Legros, 2005; Iossa and Martimort, 2010; Percoco, 2014). Public authorities (the principal) desire to maintain holdings in the port facility to control public resources for national security reasons. From the Chinese investor's (the agent's) perspective, a greater stake in the assets implies greater operational and management control, as well as a closer link between private sector profitability and port output. Indeed, Chinese port investment has turned away from equity involvement toward acquiring a controlling position in a terminal facility over the last decade (Yang et al., 2020).

There is much disagreement in the existing literature regarding the effect of port privatization on port competitiveness. Certain research demonstrates an unambiguous favorable outcome (Estache et al., 2002; Cullinane et al., 2002; Cheon et al., 2010), while others demonstrate a more equivocal link (Notteboom et al., 2000; Baird, 2000). Estache et al. (2002) discovered that decentralization and privatization of Mexican ports enhanced short-term average performance. Cullinane et al. (2002) concurred that privatization should be linked to efficiency gains (measured by subjective appraisal). Cheon et al. (2010) demonstrated that reorganizing ownership contributed to advances in total factor productivity. Baird (2000), on the other hand, stated that the amount to which the private sector intervenes in a port is directly tied to the port's role. Thus, while port privatization benefits port users when done effectively, it may have a detrimental effect on the port if privatization programs are poorly structured. Due to the lack of consensus regarding the role of private sector ownership in port competitiveness, this

study will conduct an empirical examination of the effects of Chinese private sector ownership in port infrastructure on port competitiveness.

H_4: Chinese enterprises' ownership share in the port project will affect the port's competitiveness.

When large SOEs bid for overseas port projects, they frequently create consortia with smaller SOEs and international enterprises (Liu et al., 2020). However, shareholder complexity may have a mixed effect on the port's competitiveness. On the one hand, risks and obligations can be divided among multiple shareholders, allowing individual investors to concentrate on their areas of expertise. Additionally, numerous shareholders may have expertise in port operations, shipping, or finance, which increases the probability of luring cargo to the local terminal. On the other hand, complicated shareholder structures and ties will necessitate greater communication, discussion, and negotiation around risk and responsibility allocation. As a result of Tongzon and Heng's (2005) investigation, the chapter generated the following hypothesis about shareholder complexity.

H_5: Shareholder complexity associated with the Chinese investment will affect the port's competitiveness.

Apart from investor characteristics, port competitiveness is influenced by project-specific, governance, and economic factors. The size of the project may be significant since a large-scale terminal equipped with a sophisticated collecting and distribution system will likely have greater productivity (Parola et al., 2013). Chinese investors' terminal location choices will result in varying levels of intra- and inter-port rivalry. Intra-port competition refers to competition between terminals located within a single port, which poses business risks for the Chinese investor. Inter-port competition refers to competition between terminals located in different ports. Inter-port competition has been quantified by the number of neighboring ports within a specified radius (Castillo-Manzano et al., 2016; De Oliveira and Cariou, 2015). Port investment initiatives for the long term require a stable and effective governing environment (Chen et al., 2021; Percoco, 2014; Panayides et al., 2015; Tongzon and Heng, 2005; Parola et al., 2013). Similarly, a favorable economic climate in the host country may attract foreign investment. Finally, the development condition of the host country may be crucial, as

investments in impoverished nations with inadequate port facilities may quickly pay off. Because the study is primarily focused on investor characteristics, it uses the preceding variables as control variables that reflect the port-specific and broader economic and governance environment in which the port investment occurs. The conceptual framework for the investigation is depicted in Figure 3.1.

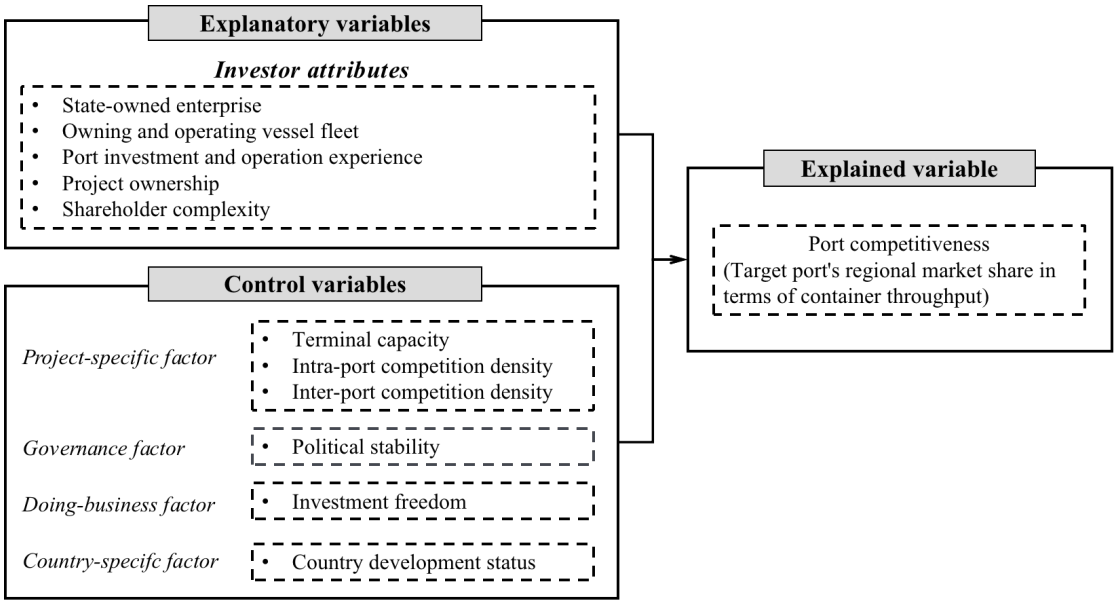

Figure 3.1: The Conceptual Framework

3.2. Variables and Measurements

The chapter created a ratio to reflect the focal port's regional market share for the dependent variable port competitiveness, based on current research: the yearly throughput of Chinese-invested terminals divided by the regional sum (Wiegmans et al., 2002; Olivier., 2010; Notteboom et al., 2012; Panayides et al., 2015). The study divided the 249 countries into 22 subregions using the United Nations geoscheme's geographical division approach (e.g., Eastern Asia, Southeast Asia). The ratio reflects changes in each terminal's regional market share following Chinese investment and regulates the intrinsic growth of each port in the region. The container throughput in TEU and terminal capacity in TEU figures for each terminal were compiled using primary data provided by terminal operators via their websites and other corporate communication channels (such as annual reports), as well as secondary data from

Drewry consulting. The Drewry consultancy's 'Annual Report of Global Container Terminal Operators' provides detailed terminal-specific information on the 21 largest international port operators' portfolios, including the terminal's name, private shareholders, capacity, and international port operators' shareholdings, and equity throughput. The country-level container throughput in TEU was derived from World Bank figures made freely available online.

For H_1 and H_2, the study created two dummy variables to indicate the Chinese investor's status as an SOE and its ownership or operation of a vessel fleet. Annual reports of corporations served as key data sources. For H_3, the experience of Chinese enterprises in port investment and operation is quantified by the ratio of their global annual throughput (in TEUs) to their global annual terminal capacity (TEUs). For H_4, the private ownership of Chinese enterprises in the port project is determined by their infrastructural holdings (Tongzon and Heng, 2005; Cheon et al., 2010). For H_5, the complexity of the shareholder structure is determined by the total number of private shareholders in the port project (Tongzon & Heng, 2005).

The literature review led to the selection of six control variables. Variables that are peculiar to a project include terminal capacity and inter-port competition density. The number of container terminals and multipurpose terminals in the focal port, as stated on the websites of the focal port authority, is used to calculate the density of intra-port competition. Google Maps satellite pictures were utilized as a visual check for accuracy. Using data from Lloyd's list intelligence's worldwide port database, this chapter calculated the density of inter-port rivalry within a 400-kilometer radius of the focal port (De Oliveira and Cariou, 2015). Global Governance Indicators (GGI) are a composite index produced by the World Bank that measures a variety of aspects of governance in a country (Chen et al., 2021; Percoco, 2014; Panayides et al., 2015; Tongzon & Heng, 2005; Parola et al., 2013). 'Doing business' factors, such as the American Heritage Fund Association's investment freedom indicator (Xiao and Lam, 2020; Teorell et al., 2016; Miller and Kim, 2015), represent the host country's economic environment, although only 2008-2019 records were available. The GDP per capita is a useful indicator of a country's development status (Kyriacou et al., 2019). Variable definition, measurement, and source are summarized in Table 3.1.

Table 3.1: Definition and Description of Variables

Latent variables	Measurement variables	Description	Source
Investor indicators	State-owned enterprise (SOE)	A dummy variable reflects whether the Chinese investor is a Chinese SOE (1) or not (0).	Company annual reports
	Owning and operating a vessel fleet (SHIPP)	A dummy variable reflects whether the Chinese investor or its company group owns or operates a vessel fleet (1) or not (0).	Company annual reports
	Port investment and operational experience (EXPE)	The Chinese enterprises' annual global port throughput is divided by their annual global port capacity, reflecting their port utilization skill.	Drewry reports and corporate annual reports
	Project ownership (OWNE)	The percentage of Chinese enterprises' shareholdings in the terminal project, reflects their commitment level to the project.	Company annual reports (Tongzon and Heng, 2005; Cheon et al., 2010)
	Shareholder complexity (PART)	The number of private shareholders in the terminal project, reflects the internal objective conflicts among shareholders.	Drewry reports (Tongzon and Heng, 2005)
Project-specific indicator	Terminal capacity (CAP)	The terminal capacity is in thousand TEUs, reflecting the project size.	Drewry reports (Parola et al., 2013)
	Intra-port competition density (INTRA)	The total number of container terminals and multipurpose terminals in the focal port, reflects the terminal-level competition.	Focal port's official website or local port authority website
	Inter-port competition density (INTER)	The total number of nearby ports within a 400 km radius of the focal port, reflects the regional port density.	Lloyd's Register (De Oliveira & Cariou, 2015)
Governance indicator	Political stability (PS)	The quality of the host country's institutional environment.	Index of governance indicators by the World Bank (Chen et al., 2021; Percoco, 2014; Panayides et al., 2015)
Doing-business indicator	Investment freedom (IF)	The logarithm of the value reflects the degree of control over the flow of investment capital including both domestic control and cross-border control.	Index of Economic Freedom by the American Heritage Fund Association (Xiao and Lam, 2020; Teorell et al., 2016; Miller and Kim, 2015).
Country-specific indicator	Country development (GDP_P)	The logarithm of the host country's GDP per capita, reflecting the economic development status of the host country.	World Bank (Kyriacou et al, 2019)

3.3. Regression Model

This study empirically explores the effect of investor characteristics on port competitiveness for a large sample of Chinese-invested container terminals using panel data regression. The study is entirely focused on port competitiveness post-investment. To ensure the internal validity of the research design, the study excludes container throughput during the contract signing year and the year the Chinese investor entered the port project, as these data reflect the circumstances before the presence of Chinese firms. As a result, the chapter counted container throughput in TEUs from the year following contract signing and regressed port competitiveness ($COMP_{Lag_{i,t+1}}$) on a set of investor variables across a one-year lag.

$$\begin{aligned} COMP_{Lag_{i,t+1}} = {} & \alpha + \beta_1 SOE_i + \beta_2 SHIPP_i + \beta_3 EXPE_{i,t} + \beta_4 OWNE_{i,t} + \beta_5 PART_i + \beta_6 CAP_{i,t} \\ & + \beta_7 INTRA_i + \beta_8 INTER_i + \beta_9 PS_{i,t} + \beta_{10} IF_{i,t} + \beta_{11} GDP_{P_{i,t}} \\ & + \beta_{12} SOE_i * INTRA_i + \beta_{13} SOE_i * PS_{i,t} + u_t + v_{i,t} \end{aligned} \quad (1)$$

Where i denotes the sampled terminal, t denotes the time, a denotes a constant, u_t denotes the period fixed effect, β is a parameter expressing the correlation between explanatory factors and port competitiveness, and $v_{i,t}$ denotes disturbance. State-owned businesses (SOE_i), ownership and operation of a vessel fleet ($SHIPP_i$), port investment and operation experience ($EXPE_{i,t}$), project ownership ($OWNE_{i,t}$), and shareholder complexity ($PART_i$) are the five investor qualities. Terminal capacity ($CAP_{i,t}$), intra-port competition density ($INTRA_i$), and inter-port competition density ($INTER_i$) are the three project-specific variables. $PS_{i,t}$, $IF_{i,t}$, and $GDP_{P_{i,t}}$ denote the host country's political stability, investment freedom, and development status. According to Yang et al. (2020), SOEs frequently evade competition from developed-country investors by investing in less appealing nations or regions with insecure political conditions. As a result, the study included two interaction variables to assess the moderating influence of state-owned enterprises (SOE_i), namely, $SOE_i * INTRA_i$ and $SOE_i * PS_{i,t}$.

3.4. Sample Selection

The data collection process begins with the identification of a representative sample of port investment projects. Chinese companies have invested in several container, bulk, and

multipurpose ports located abroad. To ensure the sample ports remained homogeneous, this chapter limited the analysis to specialized container terminals and multipurpose ports equipped to accommodate container boats. The study collects data on three Chinese firms: COSCO Shipping Ports, CMHI, and HPH. As previously stated, the three businesses have been involved in the majority of international port projects and differ in terms of corporate ownership, business specialty, and port operating experience, all of which meet the study requirements. The data collection phase identified 68 international container and multipurpose facilities in which the three Chinese companies had invested. It's worth noting that in 2013, CMHI purchased a 49% stake in CMA CGM's Terminal Link network. Thus, the chapter calculates CMHI's stake in the ten Terminal Link terminals by multiplying its 49% ownership in Terminal Link by Terminal Link's stake in each of these terminals. The information includes all investments made up to the beginning of 2020. International port investments and transactions concluded in 2021 were excluded because their impact on port competitiveness cannot be determined at this time. The three firms have continued to expand overseas in recent years, as evidenced by COSCO's acquisition of a 35% stake in Hamburg's Tollerort terminal in mid-2021 and the growth of COSCO's stock in Piraeus from 51% to 67% in the autumn of 2021.

Chapter 4

Regression and Discussion

Based on prescribed data, this chapter elaborates on the spatial distribution of sample ports and their average annual throughput growth rate, and market shares. Then, a panel data regression was completed to testify the hypotheses. A robust check was added to validate the regression result.

4.1. Sample Description

Figure 4.1 depicts the geographical distribution of ports that will receive investments from one or more of the three Chinese businesses until early 2020. HPH invested in 38 international terminals, primarily along the East Asia-West Europe shipping route, as well as in Central America and the Caribbean. COSCO Shipping Ports has invested in 14 international ports, most of which are located in the Mediterranean and Northwest Europe, with few in West America, East Africa, Eastern Asia, and Southeast Asia. CMHI invests in 18 international ports, the majority of which are located in Northwest Europe and the Mediterranean region, but also in the Caribbean, West Africa, and South Asia. HPH owns an average of 79.67% of the terminals in its global network, much more than COSCO Shipping Ports (41.13%) and

CMHI (33.35%). CMHI and COSCO together invested in Ambarli's Kumport, while HPH and COSCO jointly invested in Rotterdam's Euromax terminal.

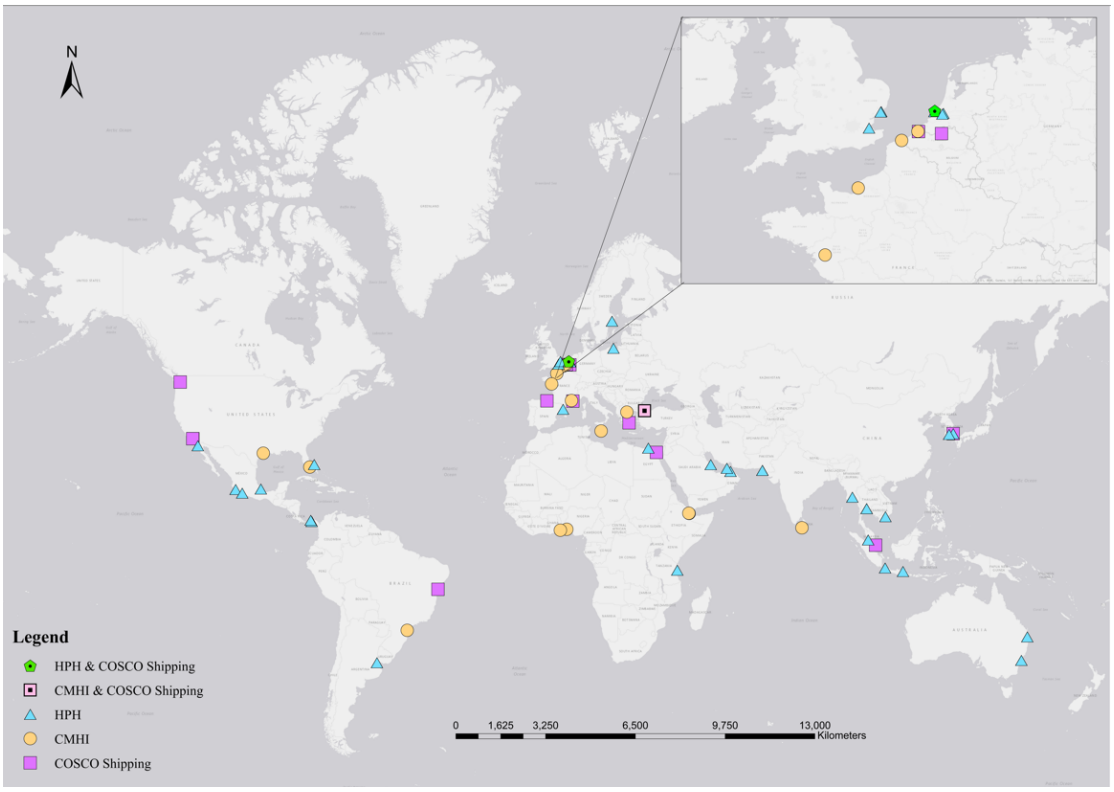

Figure 4.1: The Geographical Distribution of Ports Invested by Chinese Firms

Source: own compilation by the authors

Table 4.1 compares the sample terminals' average compound annual growth rate of container throughput and regional market share. By and large, the three Chinese investors have aided the competitiveness of their international ports. COSCO Shipping Ports' terminals expanded the fastest, 17.52% in container throughput and 22.33% in regional market share, just ahead of CMHI's (13.97% and 18.49%, respectively). HPH grew at a far slower rate than the two SOEs. Contributions from China to overseas terminals differ by geography. For instance, China-branded terminals expanded faster in Africa, Asia, Europe, and Oceania than in America (including North and South America). CMHI beat its competition in Africa, increasing terminal output and market share by 20%. HPH experienced growth of less than 10%, while COSCO Shipping Ports experienced a terminal throughput increase of only 2.34% and even lost market share. In America, Chinese SOE-invested terminals increased their throughput and

market share, whereas HPH-invested terminals decreased their throughput and market share. Throughput and market share in Asian terminals surged by over 74% as a result of CMHI's investment, followed by HPH and COSCO Shipping Ports. COSCO Shipping Ports is the most competitive in Europe, increasing throughput and market share at local terminals by 29.2% and 47.71%, respectively. For European ports, CMHI reported gains in average throughput (2.56%) and market share (13.43%). HPH-invested terminals experienced negative average throughput growth and increased market share by only 2.63%. Only HPH invested in terminals in Oceania, where it increased terminal throughput by 15% on average and market share by 18.13%.

Table 4.1: The Average Compound Annual Growth Rate of Overseas Terminal's Throughput and Market Share (Based on TEU Figures)

Classification	Investor	The average compound annual growth rate of terminal throughput (%)	The average compound annual growth rate of market share (%)
Total	CMHI	13.97	18.49
	COSCO Shipping Ports	17.52	22.33
	HPH	4.41	10.07
By region	Africa	16.87	12.47
	CMHI	25.18	19.90
	COSCO Shipping Ports	2.34	-3.57
	HPH	7.51	1.90
	America	-2.65	-0.94
	CMHI	9.34	2.09
	COSCO Shipping Ports	4.66	0.75
	HPH	-9.89	-2.34
	Asia	16.47	21.71
	CMHI	74.30	74.54
	COSCO Shipping Ports	9.34	4.19
	HPH	13.81	20.94
	Europe	7.34	16.44
	CMHI	2.56	13.43
	COSCO Shipping Ports	29.20	47.71
	HPH	-1.95	2.62
	Oceania	15.01	18.13
	HPH	15.01	18.13

The sample ports comprise a panel dataset of 68 representative terminals spanning 12 years. The descriptive statistics for all variables are presented in Table 4.2. There are 543 valid observations of port competitiveness with a one-year lag and 611 valid observations of all explanatory factors. Correlations and collinearity diagnostics for all variables are shown in Table 4.3. Multicollinearity is not a significant issue in general, as the variance inflation factor (VIF) is less than the commonly acknowledged maximum of 10.0. (Belsley et al., 1980).

Table 4.2: Sample Description

	Mean	Std	Min	Max	N	n
COMP_lag	3.38	6.81	0.00	52.47	543	68
OWNE	68.09	30.22	4.90	100.00	611	68
EXPE	0.77	0.04	0.64	0.85	611	68
SHIPP	0.17	0.38	0.00	1.00	611	68
SOE	0.32	0.47	0.00	1.00	611	68
PART	1.50	0.76	1.00	3.00	611	68
INTRA	3.65	2.89	0.00	14.00	611	68
INTER	144.76	204.56	5.00	600.00	611	68
CAP	1.69	1.77	0.05	14.00	611	68
PS	-0.05	0.87	-2.81	1.62	611	68
IF (log)	4.11	0.38	2.30	4.56	611	68
GDP_P (log)	9.53	1.27	6.35	11.13	611	68

Table 4.3: Correlation Matrix and Collinearity Diagnostics

	COMP_lag	OWNE	PART	EXPE	SOE	SHIPP	INTRA	INTER	CAP	PS	IF (log)	GDP_P (log)	VIF	Tolerance
COMP_lag	1													
OWNE	0.268***	1											2.10	0.477
PART	-0.096**	-0.438***	1										2.19	0.457
EXPE	0.081*	0.033	-0.001	1									1.02	0.980
SOE	0.036	-0.658***	0.533***	-0.093**	1								3.27	0.305
SHIPP	0.141***	-0.330***	0.633***	0.03	0.660***	1							2.73	0.366
INTRA	-0.181***	-0.103**	0.349***	0.049	0.101**	0.245***	1						1.22	0.823
INTER	0.132***	-0.021	0.174***	0.003	0.043	0.067*	0.092**	1					1.60	0.624
CAP	0.308***	-0.178***	0.232***	0.018	0.057	0.164***	0.029	0.177***	1				1.16	0.866
PS	0.055	-0.078*	0.115***	-0.02	0.105***	0.161***	0.074*	0.451***	0.169***	1			2.59	0.387
IF (log)	0.088**	-0.048	0.223***	-0.067	0.247***	0.234***	-0.013	0.497***	0.106***	0.485***	1		1.96	0.511
GDP_P (log)	0.003	-0.042	0.168***	-0.009	0.181***	0.282***	0.127***	0.535***	0.140***	0.770***	0.640***	1	3.62	0.276

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.2. Regression Result

For two reasons, this study used pooled regression on panel data. To begin, the Least Square Dummy Variable Model (LSDV) demonstrates that the majority of individual dummy variables are unrelated, indicating that pooled regression is more suited than fixed effect regression. Second, three of the five investor qualities cannot be adequately studied using fixed effect regression since their values are not time-varying (SHIPP, PART, and SOE).

The regression results for four modules are summarized in Table 4.4. Module 1 focuses exclusively on investor traits and demonstrates the validity of considering all investor factors when assessing port competitiveness following Chinese investment. Module 2 introduces six control variables and demonstrates that all traits are highly related, hence validating all hypotheses except for the one about investment flexibility. Module 3 introduces two new cross-product terms and demonstrates their significance for port competitiveness.

The chapter conducted a robustness check, as recommended by Wang & Bu (2018), by reducing the study period to 2013 – 2019 and presenting the results in Module 4. The year 2013 falls in the middle of the initial study period (2008-2019), ensuring a large enough sample size for the robustness check. There are 351 observations in all, and the mean VIF is 2.28, which eliminates collinearity effects. Module 4 merely disproved H_3 regarding the Chinese firm's port investment and operation experience. All other assumptions are supported.

Table 4.4: The Result of Pooled Regression

	Module 1	Module 2	Module 3	Module 4
SOE	3.469***	5.691***	6.566***	7.372***
	(3.59)	(6.37)	(6.98)	(6.59)
SHIPP	4.405***	4.313***	6.998***	8.130***
	(4.02)	(4.30)	(6.70)	(6.00)
EXPE	14.021**	16.281***	14.294**	12.002
	(2.01)	(2.64)	(2.40)	(1.48)
OWNE	9.440***	12.488***	11.361***	11.047***
	(7.85)	(11.30)	(10.56)	(8.12)
PART	-1.406***	-2.319***	-3.730***	-4.835***
	(-2.87)	(-5.25)	(-7.81)	(-7.57)
CAP		1.469***	1.414***	1.398***
		(10.88)	(10.85)	(8.56)
INTRA	-0.435***	-0.309***	-0.246***	-0.217*
	(-4.49)	(-3.55)	(-2.76)	(-1.85)
INTER	0.005***	0.007***	0.010***	0.012***
	(3.96)	(4.73)	(5.72)	(5.20)
PS		1.335***	1.992***	1.675***
		(3.16)	(4.42)	(2.63)
IF (log)		0.538	0.169	0.220
		(0.62)	(0.20)	(0.19)
GDP_P (log)		-2.070***	-1.974***	-1.778***
		(-5.90)	(-5.85)	(-4.01)
SOE*INTER			-0.010***	-0.013***
			(-3.48)	(-3.99)
SOE*PS			-2.950***	-3.248***
			(-4.31)	(-3.74)
_cons	-12.739**	-1.492	2.738	3.433
	(-2.29)	(-0.25)	(0.46)	(0.42)
N	543	539	539	351
R^2	0.229	0.410	0.457	0.471
Mean VIF	1.82	2.13	2.47	2.54

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5: The Hypotheses Test Result

Hypotheses	Test result
H_1: Chinese enterprises which are SOEs will positively affect the port's competitiveness.	Supported
H_2: Chinese enterprises which own and operate a vessel fleet will positively affect the port's competitiveness.	Supported
H_3: Chinese enterprises' overseas port investment and management experience will positively affect the port's competitiveness.	Refuted
H_4: Chinese enterprises' ownership share in the port project will affect the port's competitiveness.	Supported
H_5: Shareholder complexity associated with the Chinese investment will affect the port's competitiveness.	Supported

The four modules demonstrate the critical role of investor characteristics in shaping changes in the competitiveness of the focal port as a result of Chinese investment. Being an SOE, in particular, will increase a port's competitiveness. This finding is consistent with Table 4.1, as terminals invested by COSCO Shipping Ports and CMHI experienced much faster average compound annual growth rates in physical output and market share than HPH as a whole. The opposite relationship between the INTER (0.012) and SOE* INTER (-0.013) coefficients indicates that while investing in multi-port regions does not necessarily reduce port competitiveness for private companies, investing in regions with sparse ports is more conducive to capturing a larger market share for SOEs. Similarly, the coefficients of PS (1.335) and SOE*PS (-3.717) are opposite, indicating that SOEs benefit more from investing in politically unstable regions. This finding is consistent with Yang et al (2020).'s observation that SOEs prefer to invest in underdeveloped port markets.

As for H_2, the port market share gets an extra boost if the investment comes from a Chinese company that operates a container ship fleet. In this study, only COSCO Shipping owns a container fleet, and Table 4.1 shows it outperforms the other two in increasing terminal throughput and market share of all overseas ports.

Panel regression analysis of 2008 – 2019 data confirms the hypothesis that Chinese investors' port investment and operational expertise are highly associated with port competitiveness, however, this hypothesis is disproved when just 2013 – 2019 data are evaluated. This demonstrates that early in Chinese enterprises' international involvement, port operational and investment experience was important to port competitiveness. After Chinese investment, experience effects began to play a minor role in enhancing a port's competitiveness, as Chinese enterprises obtained adequate expertise in managing transnational foreign commerce. Other investor characteristics, such as corporate ownership (SOE), owning and maintaining a vessel fleet (SHIPP), and project ownership (OWNE), are more closely associated with the competitiveness of port projects. For example, although HPH was the first to go global, the capacity utilization rate of all its global ports fell from 85% to 73%. In comparison, between 2008 and 2019, COSCO Shipping Ports grew terminal utilization by 14%, from 64% to 78%, while CMHI increased terminal utilization by 11%, from 72% to 81%. As demonstrated in Table 4.1, the two SOEs have greatly boosted the container throughput and market share of overseas ports globally and regionally, for example, in Africa, Europe, and America, thereby

corroborating H_1.

Although current research has not reached a consensus on the effects of private shareholdings and the number of partners on port project competitiveness, regression analysis indicates that an increased shareholding in a port investment project will almost certainly result in a greater market share in the host country. The number of partners in a port project has a negative correlation with the competitiveness of the port.

The regression results support the selection of three project-related control variables. Terminal capacity has a high positive association with port competitiveness, implying that investments in larger terminals are more likely to result in increased market share. The association between intra-port competition density and market share is negative, implying that the introduction of more terminals in the focus port would have a detrimental effect on market share. When it comes to inter-port competition, the regression results indicate a minor but favorable association between the terminal's regional market share and the number of adjacent ports. Political stability in the host country has a considerable positive effect on the port's competitiveness. The logarithm of the host country's GDP per capita is inversely related to the competitiveness of the port, indicating that investment in port projects in undeveloped and emerging countries is more likely to result in a sizable market share. After 2013 (Chen et al., 2019), Chinese firms' overseas port investment was heavily concentrated in countries along the BRI, the majority of which are underdeveloped/developing countries with insufficient or inadequate transportation facilities. Ports in these regions expanded rapidly and progressively gained market share.

4.3. Discussion

One reason SOEs contribute more than non-SOEs is that SOEs receive more financial assistance and preferential investment terms than private enterprises, principally from the Chinese government. For example, in September 2018, President Faure of Togo visited the Togolese Business Forum in Zhejiang Province, China, along with representatives from CMHI and the China-Africa Development Fund. The forum saw the signing of a "Joint Venture Shareholders Agreement" by CMHI and Togo Investment Company (China Merchant Group,

2021). In comparison to private enterprises, major central SOEs place a higher premium on strategic and social objectives when making overseas investments (Liu et al., 2020; Bai et al., 2006) and use a longer-term perspective when making investment decisions. Central and municipal governments, as well as Chinese state-owned institutions, frequently prioritize these characteristics. Non-SOEs have limited access to non-market resources as a result of their weakened relations with the Chinese government (Nee, 1992). According to Warmerdam and van Dijk (2013), SOEs respect the function of the local embassy and Economic and Commercial Counselor's Office (ECCO) in giving information about the host country.

Owning and operating a vessel fleet is critical to a port's competitiveness for Chinese investors. Notteboom et al. (2017) also proved quantitatively that ports have a significantly increased likelihood of receiving vessel calls and corresponding container volumes from a given carrier if the carrier has a direct terminal stake in the port. Shipping corporations can act as integrators of supply chains by adjusting the global shipping network and deploying vessel fleets to the focal port. Since the 1990s, many deep-sea container carriers have established their own terminal operating subsidiaries, such as the China COSCO Group's COSCO Shipping Ports. The business has transformed Piraeus port into a regional gateway over the last decade, encouraging long-standing COSCO customers HP, Samsung, and Sony to establish a local European distribution center in its hinterland. An increasing number of carriers are increasing demand in Piraeus by utilizing the port as a maritime turntable for the extensive hub-and-spoke network in the Mediterranean and the Black Sea region, or by connecting to the port's vast hinterland, which is expanding towards the Balkans and Central and Eastern Europe via recent rail corridor investment.

Private participationin a port investment project improves port performance in the near term, which is consistent with other findings (Estache et al., 2002; Cheon et al., 2010). A significant stake in a port investment project increases investors' control over port operations and motivates them to invest significant resources in the project. For example, when COSCO Shipping Ports invested in the Port of Piraeus in Greece, the CSP Zeebrugge Terminal, and the Antwerp Gateway Terminal in Belgium, it used multiple equity acquisition models to gradually and effectively increase its control over overseas ports in the event of insufficient funds. COSCO Shipping Ports has provided the ports with unwavering financial, technical, administrative, and even labor support. Piraeus' regional market share climbed by 776% with

COSCO Shipping's takeover until 2019, and COSCO Shipping's terminals in Belgium also greatly improved their market position despite fierce rivalry from competing terminals in Antwerp and Europe's largest port Rotterdam.

According to the regression result, the number of partners in the port investment project should be limited to ensure market share growth. In a multiple shareholder situation, the distribution of risks, duties, and benefits in a port PPP project takes ample time to discuss and negotiate before reaching an agreement. This is especially true in an international company setting where stockholders may speak a different language, have a different culture, and follow distinct legal and commercial norms. If a Chinese firm is the sole owner of a terminal, strategy creation and decision-making processes may be streamlined, especially for an SOE seeking to align its actions with bigger goals such as BRI.

Because intense intra-port rivalry erodes port viability, investing in a port with multiple terminals contending for the same container flows is not recommended. Chinese firms are advised to take a balanced approach when picking overseas terminal locations, taking into account the amount of intra-port competition in the chosen destinations. For example, Chinese investment in international ports is focused on Europe and North Africa. Both regions are located within the BRI's core corridor and play a critical role in the international maritime network. Ports in northwest Europe are generally well-managed and benefit from a sophisticated financial and operational environment. Multiple terminals are managed by established international terminal operators such as APM Terminals, DP World, and PSA International. Thus, the intra-port rivalry is quite fierce in this more established cargo sector. Due to the scarcity of fresh greenfield projects in this region, Chinese firms can only participate through equity acquisition. Agglomeration effects in the port industry may account for the positive association between inter-port competition and port competitiveness. Regions with a high concentration of ports provide greater routing flexibility and higher cargo bundling and connectivity possibilities, enhancing the overall competitiveness of the cluster's ports and terminals. Notteboom (2010) shows in his analysis of the European container port system that stand-alone ports are somewhat isolated within the broader port system, as they have less functional contact with nearby ports than ports in the same multi-port gateway zone.

In summary, the findings have management ramifications for Chinese firms engaged in the

international port market. SOEs are more likely than private competitors to convert the overseas focal port into a regional container turntable, as they have more access to capital and market intelligence due to the government's assistance. An investor in a container terminal who also operates a carrier fleet is more likely to strengthen the foreign port's standing. Additionally, a larger stake in an overseas port project would enable the Chinese investor to incorporate its natural resource endowment into the port, maximizing port operations. Meanwhile, the number of shareholders in a port project should be limited, as several stakeholders are more likely to have complex risk and responsibility sharing objectives, which is detrimental to strategy implementation and port operation. When changing their location preferences for foreign port investment, Chinese investors are encouraged to take terminal- and port-level competition into account.

Chapter 5

Conclusions

Chinese firms have greatly increased their expenditures on overseas container port infrastructure construction, planning, and development during the last two decades, however not all ports have seen considerable increases in port throughput and market share. The majority of research on China-backed port investment projects focuses on qualitative findings from non-generalizable situations. While such a case-based approach could yield valuable practical insights, this research took a more quantitative and comprehensive approach to examine the impact of investor characteristics on port project competitiveness.

Whereas the majority of port investment studies focus on port-level production, the study places a premium on terminal-level performance to avoid the competitive influence of non-Chinese terminal operators operating in the same focal port. The empirical section of the paper uses panel data for 68 container and multipurpose terminals operated by three Chinese international port operators (COSCO Shipping Ports, CMHI, and Hutchison Ports) from 2008 to 2019. Pool regression is used to examine the relationship between investor characteristics, project-specific characteristics, governance indicators, business-related factors, country-specific factors, and port competitiveness. Five hypotheses were used to test the presumed relationships numerically and empirically.

The findings indicate that investor characteristics have a mixed effect on port competitiveness. The two most intriguing findings are that SOEs are more likely to advocate for a stronger market position for overseas ports, most likely because they receive more financial support from the Chinese government and have better access to market information through the embassy and other public institutions. Possessing and maintaining a shipping fleet enables a Chinese firm to expand its market share in the international port market by adjusting its shipping network and attracting cargo flows to the focal port, thereby contributing to port throughput. While intra-port rivalry at the terminal level can be detrimental to the focal terminal's market share, mild inter-port competition can help the focal terminal improve its market position. However, investment in regions with few ports or in politically unstable regions mitigates the risks associated with regional port competition and increases the focal port's market share. Additionally, private ownership enhances the port's market share, although shareholder complexity and the level of regional port competition may have a detrimental effect on the port's competitiveness. The port investments and operational experiences of Chinese firms improve the terminal's market share.

This study is not without limits. For instance, only container ports are taken into account. It is worthwhile to conduct research into the role of Chinese investor characteristics in determining the competitiveness of overseas liquid bulk and dry bulk terminals, especially given the strategic role such terminals play in ensuring the supply of energy products and raw materials to the Chinese national economy. Future research could look deeper into investor discrepancies, such as those between SOEs and non-SOEs if additional business data is obtained. Additionally, it is prudent to broaden the definition of port project competitiveness to include indicators other than the port's market share. For instance, future research could examine the effect of Chinese investment on the port's socioeconomic relevance, network connection, or financial performance. For example, while HPH did not expand market share at the same rate as the two SOEs, its financial performance may not necessarily be inferior. Thus, further research is advised to develop a quantitative technique for assessing the port's competitiveness in a more complete manner to achieve the objectives of both the investor and the host country.

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