ISCTE IUL

Instituto Universitário de Lisboa

Competitiveness of China' s Guangxi Beibu Gulf Port: Resource-based and Institutional Perspectives

ZHU Fangyang

Thesis submitted as partial requirement for the conferral of the degree of

Doctor of Management

Supervisor:

Prof. MA Shaozhuang, Associate Professor,

ISCTE University Institute of Lisbon

Co-supervisor:

Prof. Chen Xu, Professor, University of Electronic Science and Technology of China, School of Management and Economics

June, 2018

ISCTE IUL
Instituto Universitário de Lisboa

Competitiveness of China’ s Guangxi Beibu Gulf Port: Resource-based and Institutional Perspectives

ZHU Fangyang

ISCTE IUL

Instituto Universitário de Lisboa

Competitiveness of China' s Guangxi Beibu Gulf Port: Resource-based and Institutional Perspectives

ZHU Fangyang

Thesis submitted as partial requirement for the conferral of the degree of

Doctor of Management

Jury:

President: Professor Pedro Dionísio, Associate Professor, ISCTE-IUL

Professor Xiao Wen, Associate Professor, UESTC, China

Professor Li Ping, Professor, UESTC, China

Professor Carlos Rodrigues, Assistant Professor, University of Aveiro

Professor Ma Shaozhuang, Associate Professor, ISCTE-IUL

June, 2018

[This page is deliberately left blank.]

ISCTE IUL
Instituto Universitário de Lisboa

Statement of honor

Submission of doctoral thesis

I the undersigned state on my honor that:

- The work submitted herewith is original and of my exclusive authorship and that I have indicated all the sources used.
- I give my permission for my work to be put through Safe Assign plagiarism detection tool.
- I am familiar with the ISCTE-IUL Student Disciplinary Regulations and the ISCTE-IUL Code of Academic Conduct.
- I am aware that plagiarism, self-plagiarism or copying constitutes an academic violation.

Full name Fangyang Zhu

Course Doctor of Management

Student number

Email address zhufangyang@foxmail.com

Personal email address

Telephone number 15977004892

ISCTE-IUL, 31/7/2018

Signed Fangyang Zhu

[This page is deliberately left blank.]

Abstract

Guangxi Beibu Gulf Port is a crucial window connecting the Silk Road Economic Belt and the 21st Century Maritime Silk Road, an international passage to ASEAN. This study attempts to take the Guangxi Beibu Gulf Port as the object of study, explore its port competitiveness from the perspectives of resource theory and institutional environment.

This study used two sets of data which are official data of thirteen ports in 2010-2016 years and the first hand data collected from the port operators by the self-reported questionnaire.First of all, based on governmental data of thirteen ports including Beibu Gulf Port, Shanghai Port, Yantian Port and etc.from year 2010 to year 2016, the port competitiveness of Guangxi Beibu Gulf Port is comprehensively analyzed by making empirical test about the influence of port resources and institutional environment on port competitiveness, combining with the questionnaire and other first-hand materials. Second, to further valide and explain the findings from official data, this study used self-reported questionnaires to collect first-hand data from the port operators. Analyses of the two sets of data reveal the following findings.

1) the overall competitiveness of Beibu Gulf port is weak;
2) Beibu Gulf port competitiveness and port throughput are positively correlated;
3) the port resources of Beibu Gulf have not all significantly positively affecting the port competitiveness;
4) the institutional environment of Beibu Gulf port has not been able to regulate the relationship between port resources and port competitiveness;
5) the institutional environment of Beibu Gulf port has a positive regulating effect on port competition and port throughput.

This study proposes relevant policies and suggestions to improve Beibu Gulf port competitiveness.

Keywords: Beibu Gulf port; Port competitiveness; Port resources; The institutional environment

JEL: L92;L98

Resumo

O Guangxi Beibu Gulf Port é um importante porto de entrada para a Rota da Seda Marítima do Século XXI e o Cinturão Económico da Rota da Seda, além de ser um portal internacional para a ASEAN. Este artigo tenta usar o Guangxi Beibu Gulf Port como objeto de pesquisa para explorar a competitividade portuária do porto de Guangxi Beibu Gulf na perspectiva da teoria dos recursos e do ambiente institucional.

Este estudo usou dois conjuntos de dados. Dados em primeira mão de operadores portuários coletados por dados oficiais e questionários auto-relatados para 13 portos para 2010-2016. Primeiro, usando os dados oficiais de 13 portos em Beibu Gulf, Shanghai Port e Yantian Port de 2010 a 2016, foi construído um modelo de análise empírica do impacto dos recursos portuários e do ambiente de políticas portuárias na competitividade portuária. Com base no questionário e em outros dados de primeira mão, foi realizada uma análise abrangente da competitividade do porto de Guangxi Beibu Gulf. Em segundo lugar, a fim de aprofundar o estudo e explicar os resultados dos dados oficiais, este estudo utilizou um questionário auto-relatado para coletar dados em primeira mão dos operadores portuários. Os resultados da análise dos dois conjuntos de dados revelaram:

1) A competitividade global do Porto do Golfo de Beibu é fraca;

2) A competitividade do Beibu Gulf Port está positivamente correlacionada com o rendimento do porto;

3) As variáveis dos recursos portuários do Beibu Gulf não afetaram de forma significativa e positiva a competitividade portuária;

4) O ambiente institucional do porto de Beibu Gulf não ajustou significativamente positivamente a relação entre os recursos portuários e a competitividade portuária;

5) O ambiente institucional do Beibu Gulf Port tem um efeito de ajuste positivo na relação entre a concorrência portuária e o rendimento do porto.

Com base nisso, este estudo propõe recomendações políticas relevantes para melhorar a competitividade do porto do Golfo de Beibu.

Palavras-chave: Beibu Gulf Port; competitividade portuária; recursos portuários; ambiente institucional
JEL: L92; L98

摘要

广西北部湾港是我国 21 世纪海上丝绸之路和丝绸之路经济带有机衔接的重要门户港、面向东盟的国际大通道。本文试图以广西北部湾港作为研究对象，从资源理论和制度环境角度来探究广西北部湾港的港口竞争力。

本研究使用了两组数据。13 家港口 2010-2016 年的官方数据和自述调查问卷收集的港口运营商的第一手数据。首先，使用以北部湾港、上海港、盐田港等 13 家港口 2010-2016 年的官方数据，构建了港口资源和港口政策环境对港口竞争力影响的实证分析模型，结合调查问卷和其他一手数据，对广西北部湾港竞争力进行了综合分析。其次，为了进一步为研究并解释官方数据的发现，本研究使用了自述调查问卷收集港口运营商的第一手数据。对两组数据分析的结果揭示：

1)北部湾港整体竞争力较弱；

2)北部湾港口竞争力与港口吞吐量呈正相关关系；

3)北部湾港口资源变量未能全部显著正向影响港口竞争力；

4)北部湾港口的制度环境未能全部显著正向调节港口资源和港口竞争力之间关系；

5)北部湾港的制度环境对港口竞争和港口吞吐量之间的关系具有正向调节作用。

据此本研究提出了提高北部湾港口竞争力的相关政策建议。

关键词：北部湾港；港口竞争力；港口资源；制度环境

JEL: L92; L98

[This page is deliberately left blank.]

Acknowledgements

Doctoral dissertation is undoubtedly the most top-level course in Ph.D. study program. At the time of the final draft of my doctoral thesis, I am deeply touched and want to say thanks to many people.

First of all, I would like to express my sincere gratitude to my supervisor, Prof. Shaozhuang Ma. I can say that I cannot finish my doctoral dissertation writing without Ma's patience and guidance. Mr. Ma's noble quality and academic attainments influenced me. He took over to guide me when my doctoral thesis was in the most difficult period, because I hasve difficulties to communicate with Prof. Eurico Dias duo to my English proficiency, and Prof. Ma instructed me according to the project group arrangement. Prof. Ma can grasp the forefront of academic research, from the determination of the research content to the research methods and models, providing me with patient guidance and almost daily communication. There is his great devotion in my writing of every chapter, every section, every page and every word. Prof. Ma's way of guiding students is also an example for me to guide students in the future.

I would like to thank my Chinese instructor, Professor Chen Xu, whose profound knowledge has always influenced me and he is always a good example for me to learn from. I remember that after the completion of my first draft, Prof. Chen gave me very detailed analysis and revision in December 2016. I would also like to thank Prof. Eurico Dias. During my proposal time on my paper, Prof. Eurico Dias was running for the senate. Both teachers gave me very important pieces of advice during the mid-term inspection in July 2016. I thank all the faculties for the 12 Ph.D. courses: Prof. Jose Paulo Esperan C, Prof. Nelson Antonio, Prof. Virginia Trigo, Prof. Elizabeth and Professor Ma Yongkai, Professor well Yun Tian, Professor Li Shiming, Dr. Li Ping, Dr. Deng Jianping, Professor Du Yifei, and Associate Professor Chai Junwu. Their rigorous attitude, rich knowledge and tireless spirit of teaching have left me with a deep impression, which is a good example for my study and a good theoretical support for my graduation thesis. Thanks to Dr. Xiao Wen, the Director of the

ISCTE joint project group, Dr. Sun Ping and the chairman of the class, Mr. Chen Yang, who have always given me good advice and help. I am also very grateful to all the students in the class of 2014, and I learned a lot from them.

In addition, during the process of writing, I got the support and help from my organization and colleagues. Thank you to all my friends in governments and business sectors, my teachers and students, and my family for all of the selfless support given to me. My wife and son strongly supported my doctoral study; my son gave me some translation materials. These life moments always touched me. The Doctoral dissertation phase also is my most devoted time doing one thing with many whole months input. I remembered that for more than ten days during vacation in April and some weekends in Guangxi this year, I did not leave the campus even for one day. My legs between pants and socks were bitten by mosquitoes with a circle thickly dotted with blood. I could not feel it at all. I believe the doctoral thesis stage forged me. I am thankful for this opportunity to learn a lot in the highest level of education!

致谢

博士论文无疑是博士阶段最顶层课程，在博士论文定稿之际，感慨万千，想对很多人说谢谢。

首先要感谢的是我导师马绍壮教授，可以说没有马老师的耐心指导，我不可能完成博士论文写作。马老师的高贵品质和学术造诣时刻影响着我，马老师是在我博士论文陷入最困难时期接手指导我的，由于我英语表达的原因，和 Prof. Eurico Dias 交流困难，在我最需要帮助时，马老师根据项目组安排接受指导我。马老师能把握学术最前沿，从研究对象内涵的确定到研究方法、研究模型，耐心指导，几乎每天沟通，写作过程中每一章、每一节、每一页到每个词，都倾注了马老师心血。马老师指导学生方式方法也是我今后指导学生的榜样。

感谢中方指导教师陈旭教授，陈老师渊博的知识时刻影响着我，是我学习的榜样，记得在我初稿完成后，2016 年 12 月，陈老师给我详尽的分析和修改建议。感谢 Prof. Eurico Dias，我论文开题的时间里， Prof. Eurico Dias 正竞选议员，他专门抽空一个下午和我聊论文的写作。二位老师在 2016 年 7 月中期检查时都给我非常重要意见。感谢中外方 12 门博士课程授课教授：Prof.José Paulo Esperança、Prof. Nelson Antonio、Prof. Virginia Trigo、Prof. Elizabeth Reis、Prof. Jorge Lengler、曾勇教授、马永开教授、井润田教授、李仕明教授、李平博士、邓建平博士、杜义飞教授、柴俊武副教授，老师们严谨治学的态度、丰富的知识、诲人不倦的精神都给我留下了深刻的印象，是我学习的榜样，为我毕业论文的写作提供了很好的理论支撑。感谢电子科技大学与 ISCTE 联合项目组主任肖文博士、副主任孙平博士、班主任陈阳老师，他们都给我提出了很好建议和帮助，这里一并表示感谢。感谢 2014 级博士班全体同学，我从他们身上学到很多。

另外，在论文写作过程中，得到单位及同事的支持和帮助，各位政府、企业朋友们及我的学生们无私帮助，感谢各位老师无私帮助及朋友、学生对我的支持。我爱人和儿子也大力支持我博士阶段学习，儿子也给我翻译材料，这些时刻感动着我，博士论文阶段也是我最投入地在做一件事，整月整月的时间投入，记得今年四月广西假期加周末有十多天假期，我没有离开过校园，长裤和袜子之间腿上被蚊子咬了一圈密密麻麻血眼，我一点感觉不到，博士论文阶段锻造了我，感谢有这个机会了解最高学历阶段学习！

[This page is deliberately left blank.]

Contents

List of Tables

List of Figures

[This page is deliberately left blank.]

Chapter 1: Introduction

1.1 Background

Guangxi Beibu Gulf Economic Zone is located in the combination of South China, Southwest China and the ASEAN Economic Circle, which is composed of six administrative regions namely Nanning, Beihai, Qinzhou, Fangcheng Gang and Chongzuo and Yulin. It is not only the coastal area in Guangxi but also the only coastal area among China's Western Development Strategy cities.

Early in the Han Dynasty, the Beibu Gulf Economic Zone has become the origin port and birthplace of the Maritime Silk Road. In 1919, the great revolutionary pioneer Sun Yat-sen planned Qinzhou Port as the second largest southern port in China in his "Founding Strategies". It proposes that “where the land is west of Qinzhou, the port shall be chosen for the sea”. At the same time, Qinzhou Port of Beibu Gulf also brings a lot of economic advantages to Sichuan, Guizhou and Yunnan provinces.

To promote the development of the Guangxi Beibu Gulf Economic Zone, the state has issued a series of major policy measures since the reform and opening up. Though Guangxi belongs to the South China region from the geographical location, the State Council still included Guangxi in the blueprint of the development of China's western region at the beginning of this century, thus, highlighting the economic importance of Guangxi. In the implementation of the "Eleventh Five-Year Plan for Western Development" and the "Twelfth Five-Year Plan for Western Development", the state has clearly listed the Beibu Gulf Economic Zone as one of the three key development areas of the country and one of the country's eleven key economic zones with great development potential.

In the national development strategy, the Beibu Gulf Economic Zone has been successively identified as an important gateway to the outside world especially to ASEAN countries, the frontier zone and bridgehead of the China-ASEAN Free Trade Area, and

regional logistics, trade, processing and manufacturing bases and information exchange centers. At the same time, it is also planned as an important petrochemical and steel base face of the ocean. In 2002, China and ASEAN signed a package framework agreement for the China-ASEAN Free Trade Area, which including that since 2004, the China-ASEAN Expo and the China-ASEAN Business and Investment Summit will be held annually in Nanning. Since then, the Beibu Gulf Economic Zone established the status of the “bridgehead” at the forefront of China-ASEAN cooperation. China and ASEAN, who have experienced the "Golden Decade", will once again create a "Diamond Decade." Premier Li Keqiang pointed out at the 2013 China-ASEAN (10+1) Leaders Meeting that China and ASEAN would strive to achieve 1 trillion US dollars bilateral trade volume by 2020, and China would invest no less than 100 billion US dollars in ASEAN and try to build an "upgraded version" of the China-ASEAN Free Trade Area. In the new era, the strategic positioning of the Beibu Gulf Economic Zone has been shifted from the frontier “bridgehead” to leverage “strategic fulcrum”. In 2008, the government raised the Guangxi Beibu Gulf Economic Zone to a national level strategy. In Guangxi Beibu Gulf Economic Zone Development Plan, the Beibu Gulf Economic Zone was an important channel which plays the role of exchange bridge and cooperation platform positioned to serve the Beibu Gulf, the Southwest, South China and Central South, and also communicate with the East, Central and West, facing Southeast Asia. Improving Guangxi Beibu Gulf to an international economic cooperation zone with highly open, economic prosperity, social stability and environmental friendly district, and make it a strategic highland that supports and drives the country's western development is the focus of the government. In 2013, the central government proposed “the Silk Road Economic Belt and the 21st-Century Maritime Silk Road” (for short “the Belt and Road”) national development strategy. The Maritime Silk Road will drive the Pan-Beibu Gulf sub-regional cooperation with the south area, promote the cooperation between China and ASEAN port cities. The Silk Road connects Nanning, Guiyang, Chongqing, Lanzhou and other cities, thus opens the North Channel.

The Beibu Gulf Economic Zone connecting to the national strategy is a combination of multiple opportunities and comprehensive policy advantages. In particular, the overlying of

three major opportunities including Beibu Gulf Economic Zone development plan improved to national level, the upgrade of the China-ASEAN Free Trade Area and the comprehensive launch of the “the Belt and Road” strategy will make the Beibu Gulf Economic Zone an important international regional economic cooperation zone. In the Beibu Gulf Economic Zone, hundreds of billions of industrial investments enterprises will be settled, generating cluster enterprises of a certain scale and characteristics, and playing an important role in the Beibu Gulf Economic Zone. The Beibu Gulf Economic Zone is the fourth economic growth pole in China after the Pearl River Delta, the Yangtze River Delta and the Bohai Sea.

1.1.1 The belt and road strategy and the position of Guangxi Beibu Gulf Port in the strategy

When General Secretary Xi Jinping participated in Guangxi delegation's deliberation in 2015, he emphasized the role of Guangxi in “the Belt and Road” strategic plan. This aims to build an international channel to ASEAN, to create a new strategic fulcrum for southwestern and central southern regions’ opening and development and to form an important gateway to organic connecting the 21st-Century Maritime Silk Road with the Silk Road Economic Belt. The Beibu Gulf Economic Zone will undoubtedly become the core of this important gateway.

1.1.1.1The Belt and Road strategy of China

In order to deepen the cooperation with ASEAN countries, the central government first put forward the strategic concept of “the Belt and Road” at a new historical starting point when the Chinese government and ASEAN step into the 10th anniversary of their partnership (Zhao, Sun and Zhang, 2015). It is an important plan to promote the strategic development and complementary advantages of the vast number of Eurasian and Southeast Asian countries along the “Belt and Road” and to achieve common prosperity among all countries (Meng, 2015). After nearly three years of continuous advancement, the “Belt and Road” has become one of China’s core development strategies (Wang, Zhang, Yang & Hong, 2016). On the one hand, the implementation of “the Belt and Road” strategy is conducive to breaking the traditional economic regional scope, promoting coordinated development of regional economies along the line, and bringing the economic and trade cooperation of countries along

the line to a new level (Cao,2015; Li & Cui,2015). With the help of the “Belt and Road” strategy, the economic and trade cooperation between Europe and Southeast Asia will be stimulated and can narrow the development gap among the countries along the “Belt and Road” and enhance the deep development of China's central and western regions and the pan-economic circle, emerging new growth poles of regional economy (Feng, 2014; Bai & Wang, 2014). On the other hand, the implementation of the “Belt and Road” strategy will help China to practice the diversification market strategy, resolve potential risks and expand exports, and alleviate the pressure of overcapacity. The construction of the "Silk Road Economic Belt" is precisely the way China explained doubts from the other countries and declared a peaceful rise to the world (Sun, 2014). Finally, the implementation of the “Belt and Road” strategy will help China demonstrate global diplomacy strategic innovation (Zhang, 2014). The "Maritime Silk Road" can further strengthen foreign cooperation and exchanges between China and other countries, inject new vitality into China's neighboring foreign policy, and make "Chinese Voice" more appealing and cohesive on the world stage (Zhang, 2014).

1.1.1.2The strategic position of Guangxi Beibu Gulf Port in the “Belt and Road”

Hepu, on the banks of the Beibu Gulf, opened the maritime trade route between China and Southeast Asia and South Asia since the Western Han Dynasty, and became one of the originating ports of the ancient “Maritime Silk Road” (Long, 2017). General Secretary Xi Jinping when investigate in Guangxi pointed out that Beibu Gulf Port has become the most convenient seaport in Southwest China and Central South China, forming an important organic connection gateway for the “Belt and Road”. Under the guidance of the “Belt and Road” strategy and the important guiding spirit, Guangxi government strives to build a new pattern of open development in the Beibu Gulf Economic Zone and even in the whole Guangxi (Zhang, 2018). In recent years, in order to promote the infrastructure interconnection and interoperability with countries along the “Belt and Road” and to enhance the comprehensive opening capacity of transportation, Guangxi has built an international channel face to ASEAN based on the Beibu Gulf Port, forming a port city cooperative network among China-ASEAN (Liu, 2017; Wang, 2017). Beibu Gulf Port is the closest estuary from the southwestern China to the Southeast Asia countries along “the Belt and Road”. It is also one

of the most complete ports for the construction of China's coastal railways. It is the main battlefield and vanguard of economic and trade transportation between China and Southeast Asia. Under the new development background and the deeply trend of “the Belt and Road” strategy, Guangxi Beibu Gulf Port should actively expand the international cooperation space in order to strengthened the interoperability with “the Belt and Road” related areas, especially the interconnection between Beibu Gulf Port and ASEAN Port (Tong, 2017). The Beibu Gulf Port will rely on the strategic position, actively take over the development needs of countries along the “Belt and Road”, deeply integrated into the countries along the “Belt and Road”, play a portal role when China continues to promote the “Belt and Road” strategy and accelerate trade with Southeast Asian countries. As the portal and frontier of the Belt and Road especially the 21st Century Maritime Silk Road, the Beibu Gulf Port will inevitably play a more important and prominent role in “the Belt and Road” strategy (Wang, 2017).

1.1.1.3Academic discussion from different perspectives

There is little direct research on the strategic position of Guangxi Beibu Gulf Port in “the Belt and Road” strategy among the existing literatures. However, in recent years, some relevant literatures about the development of Guangxi in the “Belt and Road” strategy have been published. Reseachers discussed Guangxi's status under the “Belt and Road” strategy and its development strategy from the following different perspectives.

First, from the perspective of location economy, they discussed the advantages, disadvantages, opportunities and challenges faced by Guangxi economic development and the significance of the development and opening up of border areas to national border security and stability and regional economic cooperation. Planned the overall space and constructed the economic belt along the border from theoritical (Yang, 2016), and put forward development countermeasures from the aspects of capital, information, infrastructure, investment soft environment among others (Liao & Long, 2017).

Second, from the perspective of foreign trade economic development, researchers have proposed the implementation of border trade transfer and upgrading projects, promote exports, and deepen full range open and cooperation (Yang, 2016). It is necessary to make full use of the policy advantage and the chance of China-ASEAN Free Trade Area upgrading, to build

Guangxi into a new strategic fulcrum for the opening up of Central and South China (Peng, 2017). Emphasizing the adjustment of the marine industry in Guangxi Beibu Gulf Economic Zone has important strategic significance for both the development of new business industries along the line and consruct a new open pattern for the region, as well as expand new space for the marine economy development (Chen, Mao, & Li, 2017).

Third, from a perspective of geographical location, there is a discussion on the importance of geographical location, natural resources and competitive economic cooperation conditions for Guangxi to strengthen sea, land and air trade communication and cooperation with ASEAN countries (Li, Cui, & Xiang, 2018). By analysizing the constraints of economic level, industrial structure competitiveness and traffic conditions in Qinzhou, Feng (2015) proposes that Qinzhou should establish a regional perspective from the regional economic center, international shipping logistics center and industrial agglomeration cooperation zone to build an open international portal. Defining the positioning and development strategy of the hub-type portal city, and based on the perspective of comparative advantage, the researchers suggest that Guangxi should strengthen economic cooperation with ASEAN countries (Zhang & Wang, 2015). Furthermore, Tao (2016) puts forward how to grasp the strategic opportunities and challenges of “the Belt and Road” after detailed analysis and compare the reality of Guangxi's economy, politics and geography.

Fourth, from the perspective of logistics industry development, Li (2016) analyzes the development status and puts forward the development countermeasures of Guangxi modern logistics industry to adapt to “the Belt and Road" strategy. In another research, Qin (2016) puts forward the idea of constructing Guangxi international port based on the advantages of Qinzhou Port location and external foundation, and strengthens the port cooperation and innovation development of infrastructure, collection and distribution system and port industrial park. Huang (2015) used SWOT to analyze Guangxi logistics industry development, and proposed policy recommendations for the improvement of Guangxi's logistics infrastructure. Liu (2015) constructed the strategic idea of building international cruise port docking “the Belt and Road”, after analyzing the advantages of Guangxi's development of multimodal transport construction, proposed the development of Guangxi multimodal

transport framework.

In summary, scholars have explored the status and development strategy of Guangxi under “the Belt and Road” strategic background from different perspectives, and achieved relatively rich results, but the research on the competitiveness of Guangxi Beibu Gulf Port is almost blank no matter it is theoretical exploration or empirical analysis, which provides a huge research space for this study.

1.1.2 A review of port economy research

The port economy takes advantage of the port area of the port, with the coastal area as the center and the hinterland as support, and the port as the window as well as the port city as the carrier, rely on the related industries, the integrated transportation system as the artery, to realize a coordinated development of the open economy between the port industry and the region (Wang & Slack, 2000; Zhao & Lv, 2005; Song, Wang & Lin, 2007; Yin & Mou, 2011; Xu & Du, 2012).

Base on the definition of port economy, from the existing related research main focus on the following aspects: First, it is the related research on port and regional economic development. For example, research on the relationship between port infrastructure and port city economy (Si, 2012), economic development between port economy and coastal areas (Jiang, 2010; Xu & Du, 2012) and urban economic development (KlinK, 1998; Kuang, 2007) existing strong interactivity. Promote the economic integration development of the coastal areas (portal areas) and the port city (Kuang, 2007; Jiang, 2010; Xu & Du, 2012; Xu & Zhu, 2004; Yang & Zong, 2008; Guo, 2009). With the development of technology in the maritime industry, the public's understanding and utilization of offshore resources and emerging multimodal transport systems have gradually deepened; port cities have begun to modernize their development opportunities (Hayuth, 1982). The hinterland development plays an important role in the port economic development (Zhu Chuangeng, 2009); Duan & Mou, 2011). Based on Mayer (1957) and Welgend (1958), conducted a study on the competition in the hinterland of the port, pointing out the decisive role of the comprehensive cost from water-port-land. Kenyon (1970) and Mayer (1978) emphasized that the factors determining

the competition in the hinterland include labor costs, railway connectivity, port accessibility and land availability. Hayuth and Slack believe that the port hinterland will continue to expand with the development of economy and railway technology, and the relationship between the port and the hinterland will become more complex and diversified, while the sustainable development of the port and its hinterland cities will be further attracting academic attention (Hooydonk, 2007). It can be seen that there is a close relationship between the port and regional economic development.

Second, the accounting and efficiency analysis of the port economy (Kim et al., 1986; Talley, 1994; Song et al., 2010; Shen & Yu, 2014). They measure the economic efficiency of the port by adopting input factor productivity (Kim et al., 1986), unit dollar profit of goods (Talley, 1994), optimal throughput (Sachish, 1996) and index system of port berth, length of dock shoreline, foreign economic and trade, marine economic planning and macroeconomic policy (Shen & Yu, 2014).

The third is the research about port economy sustainable development (Chen, 1996; Hou, 2010). Researchers believe that port cities, regional economy, resource and environment, port functions, port industries and integrated transportation constitute the main content of sustainable development of port economy, and only the various contents coordinated developing can promote the port economy sustainable development.

Fourth, researches on port competitiveness (Yu, 2003; Sun & Shao, 2009). Sun and Shao (2009) used the Michael Porter diamond model research and pointed out that the improvement of China's port competitiveness should mainly start from the production factors, the development of port information, the port service industry and the coordinated development of ports and coastal cities.

In recent years, in terms of evaluating and improving the study of port competitiveness were relatively rich in foreign theories. Based on the logistics industry, Miler et al., (2014) explores the feasibility of upgrading the competitiveness of the southern Baltic Sea. Based on the multi-standard evaluation model of the unique logistics characteristics of the port, this study proposes a Seaport competition level assessment method which combined with the ability analysis and AHP to determine the unique criteria, sub-criteria and diagnostic

characteristics of the assessment (partial logistics costs). Port competition is not a very clear concept, in part because of its complexity, the nature and characteristics of competition depends on the type of port it contains (eg large ports, small inland ports, transit ports) and commodities (eg containers and Liquid volume) (Notteboom & Yap, 2012). The competition in the port can be divided into three types: the first type is that the intra-port competition is carried out between the terminal operators in the designated port, and the scope of competition includes all aspects of the container trade, such as the relevant traffic routes, shippers and shipping companies; the second type is that terminal operators must compete with terminal operators located in other ports. This is called “inter-port competition” and this competition can take place between countries and regions. The third type is competition between ports, and between multiple terminals located in different ports (Voorde & Winkelmans, 2002). The competitiveness of a container port depends on its competitive quote price to shippers and shipping companies on specific trade routes, geographical regions and other ports. In fact, the competitiveness of a container port depends on a series of competitive advantages that the port has long acquired or created (Haezendonck & Notteboom, 2002).

According to the above, it is not difficult to find that the development of the port economy not only involves the impact of port infrastructure, port natural conditions, port cargo throughput, but also affected by the combined effects of economic development level of the port hinterland economy and its cities, the degree of foreign trade and macro economic policy and other multiple factors, which correspond to resource-based view and institional theory respectively.

Conversely, the development of the port economy is also related to the development of port cities and regional economies. With the deepening of economic globalization and trade globalization, the role of the port as a bridge for commodity, goods and international tourism has gradually become prominent in the economy and society. This has made the study of the port economy gradually become a hot issue of widespread concern in the academic community. However, the core issue of developing the port economy and then driving the development of the city and even the regional economy is to develop the port itself, improve the port infrastructure, expand the port-based industry, and continuously improve the port's

comprehensive competitiveness. In the final analysis, the development of the port economy is the process of the development and upgrading of the port itself and its comprehensive competitiveness.

1.2 Research objectives and questions

1.2.1 Objectives

From the research background, we can see that Guangxi Beibu Gulf Port is backed by the southwest China and facing Southeast Asia. It is a combination of economic circles such as ASEAN, South China and Southwest China. It is not only an important gateway port for the organic integration of "the Silk Road Economic Belt and the 21st-Century Maritime Silk Road" but also an international channel to ASEAN and a new strategic fulcrum for the opening up of southwestern and central southern regions.

Since 2009, three ports (Beihai, Qinzhou, Fang Chenggang) have merged into one. With the approval of the Beibu Gulf Economic Zone Development Plan and the national and autonomous regional platforms such as the Zhongma Qinzhou Industrial Park and the Qinzhou Bonded Port Area, the infrastructure, routes and throughput (including container throughput and port cargo throughput) of the Guangxi Beibu Gulf Port has been greatly developed.

However, compared with Tianjin Port, Shanghai Port, Ningbo Port and other major coastal ports in China, current development situation of Guangxi Beibu Gulf Port still has a big gap in infrastructure, routes number and density, collection and distribution system and port informationization. Taking container throughput and port cargo throughput what reflecting port production capacity and operation development as example, by 2016, the port cargo throughput and container throughput of Guangxi Beibu Gulf Port were 20,392 tons and 1.75 million Twenty-feet Equivalent Unit (TEU) respectively (where Qinzhou Port's throughput is 1.37 million TEU, Fang Chenggang and Beihai Port only had 240,000 TEU and 140,000 TEU respectively). Compared with southeast coastal ports shuch as: Shanghai Port, whose container throughput and port cargo throughput are 37.13 million TEU and 7005 tons

respectively, and Dalian Port, whose container throughput and cargo throughput are 9.85 million TEU and 42873 tons respectively, it can be seen that, for the large gap with them, Guangxi Beibu Gulf Port are far behind of them and at a disadvantage in this area.

A series of factors, such as port facilities condition (wharf, the number of production berth, waterway, warehouse and yard, port service capacity), the level of specialization and informatization, port operation efficiency and customs efficiency, may be the reasons for the unsatisfactory development of Guangxi Beibu Gulf Port.

According to Wernerfelt's view of resource theory, resources are a collection of all tangible and intangible assets of an organization over a certain period of time, including brands, technical knowledge within the organization, trade, machinery, efficient procedures, and capital. From a resource perspective, he analyzes companies that implement differentiated strategies to capture competitive advantages that competitors find it difficult to replicate through creative resource pools (tangible and intangible resources) and operational activities, and apply them to corporate strategic decisions (Wernerfelt, 1984; Wen & Liu, 2007). Infrastructure, service capacity, specialization and information level, port operation efficiency among others are all unique tangible and intangible resources owned by enterprises. Well, some obvious questions are that have these resources achieved the “Pareto optimality” in Guangxi Beibu Gulf Port? For Guangxi Beibu Gulf Port, what impact do tangible and intangible resources such as port infrastructure, port operation efficiency and port service capacity have on port competitiveness? And what is Guangxi Beibu Gulf Port competitive position among the main ports in China? These are exactly the questions that this study prepares to discuss.

Although Qinzhou Port, Beihai Port and Fangcheng Port were merged to form the Guangxi Beibu Gulf Port in 2009, and was conducted integrated management, there are still some problems such as: a waste of resources in the infrastructure investment of Qinzhou Port, Beihai Port and Fangcheng Port, homogeneity and vicious competition in the aspects of route developing, the introduction of shipping and forwarding companies, and the management system is not perfect too. At the same time, Government intervention and non market operation are conducted on Guangxi's Beibu Gulf stock price.

As for the collection and distribution system, the "Chongqing-Guangxi-Singapore" South-Oriented Channel is being constructed, and the major international corridors and logistics systems which are opening to the southwest, central and southern provinces and cities, connecting ASEAN countries, Europe and the United States have not yet been fully formed. In terms of transportation cost, the container railway transportation cost of shipping to Beibu Gulf port is much higher than that of shipping to Guangzhou port, Shenzhen port and other eastern coastal ports. Therefore, the market pricing mechanism of transportation cost has not yet been formed properly. In addition, the level of Guangxi's financial development, the degree of opening up and legal environment are the main factors affecting the development of Guangxi Beibu Gulf Port too. The above factors, in summary, are the institutional environment which has an important impact on Guangxi Beibu Gulf port.

The change of institutional environment will inevitably affect the optimal allocation of tangible and intangible resources in Guangxi Beibu Gulf Port and change the level of port competitiveness. Therefore, the study of the relationship between port resources and port competitiveness moderated by institutional environment which mainly be measured by the level of marketization become another important issue in this paper.

Based on the above analysis, there are three research objectives of this study. First, by rigorous theoretical analysis and literature review, based on the current development status of Guangxi Beibu Gulf Port (the development status of Guangxi Beibu Gulf Port is described in detail in Chapter 3). Quantitative measure of the comprehensive competitiveness of Guangxi Beibu Gulf Port, and comparative analyzes of the current position of Guangxi Beibu Gulf Port competitiveness among China's coastal major ports is also discussed. Secondly, from the perspective of resource theory and institutional environment, this study establishes theoretical and empirical analysis models, empirically test the impact of port resources such as tangible and intangible resources in Guangxi Beibu Gulf Port on port competitiveness; empirically test port competitiveness and port throughput, empirically test the impact of port competitiveness on port throughput, and then reveal the relationship among port resources, institutional environment, port competitiveness and the port throughput. Finally, the paper focuses on the internal causes of the above results and proposes relevant policy recommendations, which in

turn provides theoretical and decision-making basis for the government to promote the competitiveness of Guangxi Beibu Gulf Port.

1.2.2 Research questions

According to the research objectives, the advantages, opportunities and challenges faced by Guangxi Beibu Gulf Port, and the established environment have the same or similar impact on all enterprises in the same environment. The main reason for the difference in competitive strategic performance between enterprises is the quantity, quality and operation efficiency of the resources the enterprise owned or controlled (Teng & Huang, 2004; Ge & Xiao, 2007). This study, therefore, attempts to answer the following questions:

(1) What is the current position or status of Guangxi Beibu Gulf Port competitiveness in China by measuring the comprehensive competitiveness of Guangxi Beibu Gulf Port and other 12 ports?

(2) How does the port resource promote the competitiveness of Guangxi Beibu Gulf Port? This involves the analysis about the impact of tangible and intangible port resources, which are the port facilities conditions, port connectivity conditions and port operation efficiency, on port competitiveness of Guangxi Beibu Gulf Port and results discussion.

(3) How does the institutional environment, as an external factor, moderate the development of the Guangxi Beibu Gulf Port?

(4) How does the competitiveness of Guangxi Beibu Gulf Port promote port throughput?

Finally, by answering the above questions, we will further clarify the port competitiveness of the Guangxi Beibu Gulf Port, and then propose effective measures to enhance the competitiveness of the Port, and thereby promote the development of the Guangxi Beibu Gulf Port.

1.3 Research methods

This study intends to use quantitative analysis method, using government statistical data and questionnaire survey data of managers and employees in Guangxi Beibu Gulf port to

answer the research questions, the specific methods are as follows:

Regression analysis method is used to analyze the relationship between independent variables (port hinterland economy, port logistics supply, port operation services), mediaing variables (port competitiveness), moderating variables (institutional environment) and dependent variables (port throughput), then verify the hypothesis. Data Envelopment Analysis (DEA) is used to calculate the efficiency (for measuring the ports competitiveness); Factor analysis is used to reduce the dimension of multiple sub-indicators below each index.

1.4 Structure

This thesis consists of five chapters.

The first chapter is introduction. This section mainly introduces the research background, objectives and questions, research methods and the overall structural framework of the thesis. The second chapter is literature review. It mainly reviews the theoretical perspectives including resource theory, institutional theory related to this study and related literatures on the variables that this study focuses on. At the end of this chapter, we present the hypotheses and theoretical models of this study. The third chaper introduces Guangxi Beibu Gulf Port. The Guangxi Beibu Gulf Port is the object of this research. In this section we introduce Qinzhou Port, Fangcheng Port and Beihai Port from academic perspective in detail. The fourth chapter is the empirical research. This section describes the overall design of the study and the method used to accomplish the research objectives and demonstrates the analytical process and conclusions. The fifth chapter is discussion and conclusions, and we conduct a detailed discussion based on the analysis of the results, and summarize the contributions and limitations of this study，and we recommend some corresponding policies based on the conclusions of the study.

Chapter 2: Literature Review

2.1 Port competitiveness

2.1.1 Concept of port competitiveness

According to Zou and Yan (1998), the study of port competitiveness by Chinese researchers began in 1998. Early scholars' research on port competitiveness generally analyzes and discusses some aspects that have an impact on port competitiveness, and thus draws a strategy to improve port competitiveness (Yu, 2003; Huang, 2009). Subsequent researches focused on the objective evaluation of port competitiveness. In order to ensure the objectivity of evaluation, scholars have adopted different research methods such as factor analysis methods (Zhou & Di, 2011; Wang & Han, 2012), the main Component Analysis Method (Ren Chengyu, 2011), the Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS) method (Teng & Hu, 2017) and DEA method (Teng & Hu, 2017). The scholars' research in this period strives to evaluate the objectivity of the method, but since no one gives a clear definition of the port competitiveness concept, each person builds an evaluation index system according to their own understanding, and the evaluation results are different and have no comparability.

Judging from the development of port competitiveness in this study, the concept of port competitiveness is derived from the competitiveness of enterprises. Prahalad and Hamel (1990) argue that a company's competitiveness is the “key capability” of the company, or that “core competence” that enables the company to obtain specific benefits and turn into long-term advantages to gain a competitive position in the market. Porter (1990) defines competitiveness as the skill or talent generated by acquiring knowledge that creates and sustains the high performance of competition. Drucker (2002) argues that competitiveness should be interpreted as a sign that companies are gaining market success through innovation and shaping entrepreneurship. The factor that determines the existence of competitiveness is innovation. Through innovation, we can expand the market supply, improve and improve the

quality of the products and services provided, maintain qualified staff and their high productivity, and ensure customer satisfaction. In terms of port competitiveness research, early scholars have found that there is fierce competition between ports in the same port or adjacent hinterland, between port operators and even between port authorities (Haezendonck et al., 2000). The internationalization of port policies and the increase in port autonomy are among the reasons for the fierce competition between ports. In addition, foreign scholars' research on port competitiveness focuses on port location, port throughput, and route connectivity and diversity (Pearson, 1980; Willingale, 1981; Collison, 1984; Fleming & Baird, 1999; Lirn et al., 2003, 2004; Tai & Hwang, 2005) and other factors affecting port competitiveness.

Regarding the definition of port competitiveness, scholars often define port competitiveness from different angles and aspects. For example, port competitiveness is defined as the extent of gaining or creating a port's competitive advantage over time (Haezendonck & Notteboom, 2002; Huybrechts et al., 2002); It is the ability of countries or regions to stimulate the port industry to meet more diverse needs by expanding or improving port infrastructure and services (Yeo & Song, 2006). It is determined by port competition, while port competition is subject to operators and ship routes that connect to other ports and provide specific trade routes or regional services (Notteboom & Yap, 2012). Port competitiveness includes port cost, service quality, reliability, agility and customized services (Song & Panayides, 2008).

Domestic research on the concept of port competitiveness, like foreign countries, is also based on the evolution of the concept of competitiveness. The source of corporate competitiveness is the integration of the company's own resources and internal capabilities, and the ability to interact with external competitors to better meet consumer demand than competitors (Bo & Yi, 2007). The most intuitive manifestation in the market economy is that the products or services provided by the enterprise to the market are more effective than other enterprises, and at the same time, they can continuously develop and expand their own capabilities or comprehensive qualities in the market (Jin, 2003).

Some scholars combine the relevant viewpoints of resource theory with the competitiveness of enterprises to form the concept of port core competitiveness (Xu, 2006; Dong, 2011; Liu, 2006; Chen, 2006). The core competitiveness of the port is a collection of knowledge, technology, capital and other factors that have a competitive advantage in the port. This competitive element enables port enterprises to maintain long-term competitiveness and obtain excess profits (Xu, 2006) and it is both economic and social (Dong, 2011; Liu, 2006; Chen, 2006). It realizes the creation and sustainable development of port value by integrating and optimizing the interaction between internal resource elements and the external environment. Other scholars explain port competitiveness from a systemic perspective (Zheng, 2008; Sun et al., 2013; Li, 2016). Specifically, Zheng (2008) pointed out that port competitiveness is the system capability of the port to optimize the allocation of resources. This capability is achieved by the port enterprises through the optimal allocation and combination of their own elemental structure and interaction with the external environment. It is characterized by the comparative ability of port enterprises relative to other ports in terms of market possession, value creation and sustainable development.

Specifically, port competitiveness includes three competitive advantages: resource competitive advantage, structural competitive advantage, and competitive advantage. The natural resources, infrastructure, economic resources and soft resources of the port, as well as the collection and distribution system and service system constitute the competitive advantage of resources; The berth structure, cargo structure and economic development capacity of the port are the main contents of the structural competitive advantage; The ability to compete for competitiveness is mainly reflected in infrastructure construction capabilities, service system improvement capabilities, throughput capabilities, and innovation capabilities (Zheng, 2008). Li (2016) pointed out that port competitiveness refers to a logistics system integrating manufacturing, transportation and service. It uses a multi-functional logistics system to promote the value of goods or services, thereby maximizing market returns. The improvement of port competitiveness plays an important role in promoting the development of international trade, the optimal allocation of production factors and the deep division of international trade specialization. Sun et al. (2013) elaborated port competitiveness from the perspective of

system theory. He believed that port competitiveness is a port enterprise that differentiated itself from other ports by optimizing the allocation and reconstruction of its own elements in the process of production management. The competitive advantage and the unique advantages of bringing excess profits to the hinterland economy are also the port's ability to outpace other markets in terms of market share and excess profit creation and the promotion of sustainable coastal development.

In addition, Huang (2009) pointed out that the development of regional economy and port is mutually influential in an open economy. Port competitiveness can promote the organic integration of regional economy and port-related industries. The port competitiveness is driven by the port as the center, the port city as the carrier and the port enterprise, and the transportation as the artery and the hinterland Implemented for support. Zhou and Di (2011) found that the port is not only a node for resource collection and processing, but also a growth pole for regional economic development. With the development of the international economy and the increasing exchanges, the expansion of port functions has also intensified the competition between ports. It also shows that the improvement of port competitiveness can significantly promote the development of the local economy. According to the above definition, the port competitiveness structural dimension: infrastructure, production capacity, hinterland economy, development potential. On the basis of this, the combination of entropy weight method and TOPSIS method is used to comprehensively evaluate the competitiveness of coastal ports in China. In addition, the definition of port competitiveness is also discussed by other scholars and will not be repeated here. The details are shown in Table 2-1.

Based on the above literature review, scholars who study enterprise competitiveness define enterprise competitiveness from two aspects: formation mechanism and external performance; Scholars who study port competitiveness see the port as a system that defines port competitiveness from the perspective of the internal elements of the system and its interaction with the external environment. On this basis, we believe that port competitiveness is formed by port companies integrating their own resources and intrinsic capabilities in an environment of external competition, providing services to the market more effectively than other competitive ports to meet market demand, and the ability to develop itself.

Table 2-1Definition of port competitiveness

Scholar and time	Definition and main point of view
Haezendonck et al. (2000)	Port competitiveness depends not only on internal core competitiveness factors such as production service capabilities, human resources, and management levels, but also on external factors such as geographic location, number of global freight companies, and international factors.
Haezendonck and Notteboom (2002); Huybrechts et al.(2002)	Port competitiveness is defined as the extent of gaining or creating a port's competitive advantage over time.
Yeo and Song (2006)	It is the ability of a country or region to stimulate the port industry to meet more diverse needs by expanding or improving port infrastructure and services.
Xu (2006)	The combination of knowledge, technology, capital and other factors of competitive advantage enables port enterprises to maintain long-term competitiveness and obtain excess profits.
Sun (2006), Sun (2007)	In the production, operation and management process, there is a planned and gradually formed unique competitiveness that is not easy to be emulated by competitors and can bring excess profits.
Theo Notteboom and Wei Yim Yap (2011)	Port competitiveness is determined by port competition, while port competition is subject to operators and ship routes that connect other ports and provide specific trade routes or regional services.
Kuang(2007),Xu (2016)	The port's ability to attract different resources is a comprehensive system concept, reflecting the comprehensive strength of the port in terms of location conditions, hinterland supply potential, port natural resources, collection and distribution system, infrastructure construction, supporting service facilities and soft environment.
Liu (2006), Chen (2006) ,Zheng (2008), Dong (2011),	Port enterprises are economically and socially realized through the optimal allocation and combination of their own elemental structure and the interaction with the external environment.
Zheng (2008)	The port's system capabilities for optimal resource allocation, including resource competitive advantage, structural competitive advantage and competitive advantage
Song and Panayides (2008)	Port competitiveness includes port cost, service quality, reliability, agility and customized services.
Huang (2009)	With the port as the center, the port city as the carrier, the port enterprise as the support, the transportation as the artery and the inland hinterland as the basis to achieve the organic integration

	between the regional economy and the port-related industries.
Sun (2013)	It is the port enterprise's optimization and configuration and reconstruction of its own elements in the process of production management.
Sun and Shao (2009)	It can provide continuous production and service to port consumers such as ship, cargo and passengers more effectively than other ports.
Li (2016)	It refers to a logistics system that integrates manufacturing, transportation and service. It uses a multi-functional logistics system to promote the value of goods or services, thus maximizing market returns.
Li (2017)	Port enterprises provide the ability and opportunity for high-quality and low-cost services for related enterprises and industries in a competitive market environment, thereby maximizing the value of port enterprises. It has the characteristics of complex levels, oligopoly and many competitive factors.

2.1.2Measurement and evaluation of port competitiveness

At present, the research on the measurement and evaluation of port competitiveness in academic circles mainly focuses on the analysis of the influencing factors of port competitiveness, the construction of port competitiveness index system and the research on port competitiveness measurement and evaluation methods.

2.1.2.1Factors affecting port competitiveness

In the analysis of the factors affecting port competitiveness, Chinese and international scholars mainly focus on the following factors. The first is the analysis of port labor costs (Kenyon, 1970; Ma, 2007), the connection between rail transport and ports, and the impact of port cargo accessibility on port competitiveness (Kenyon, 1970; Fleming & Baird, 1999).

The research found that lower port labor cost form a good railway transportation connection with the port, the smooth port cargo access network is conducive to promoting the port competitiveness, and vice versa. The second is to explore the impact of port (production) service level and service quality (Foster, 1978; Ma, 2007; Li, 2017), convenience and port waiting time (Foster, 1978) on port competitiveness. The improvement of service level, service quality and port convenience, and the relative reduction in waiting time are conducive

to the improvement of port competitiveness. Third, a large number of studies have shown that natural conditions such as geographical location (Pearson, 1980; Willingale, 1981; Collison, 1984; Tai & Hwang, 2005, Ma, 2007), port infrastructure (Yu, 2003, Ma, 2007, Li, 2017; Teng & Hu, 2017; Li, 2017) are important factors affecting port competitiveness. Whether the geographical location is superior or not, and whether the port infrastructure is perfect is directly related to the operation scale of the port. Fourth, some studies have shown that the number and density of routes (Foster, 1978, Claudio Ferrari, 2006; Tang et al., 2007) are also important factors reflecting the size of port competitiveness. The number of routes and the amount of density not only reflect the throughput of the port, but also an important manifestation of port influence or competitiveness. Fifth, information technology (E-Lee-Partridge, 2000) and logistics information system (Ma, 2007) and other information technologies are also important aspects of port competitiveness. Sixth is concerned with the impact of operational capabilities and soft resources (Li, 2017), port efficiency (Robison, 2002) and management level (Li, 2016).

The influencing factors mentioned above such as natural conditions, infrastructure, port production service level and service quality, route quantity and density, information technology, production and operation level and management level are all intrinsic resources according to the resource theory. In addition, some other scholars have also analyzed the factors affecting port competitiveness from external conditions. Their research shows that the economic factors of the hinterland (Kenyon, 1970; Yu, 2003; Li, 2016; Teng & Hu, 2017), related industries and laws and policies (Ma, 2007) and other external factors are the most important factors affecting port competitiveness.

It can be seen that port competitiveness cannot be fully reflected in one aspect, but natural resources, terminal infrastructure, port economic hinterland, supply agglomeration, logistics services, foreign trade, routes, collection and distribution systems (including railways, highways, aviation and sea-rail combined transport), management level and a combination of multiple factors such as industry and macroeconomic policies. Therefore, the factors affecting the competitiveness of the port are comprehensive and multi-level complex systems including internal and external factors of the port.

2.1.2.2Evaluation index system of port competitiveness

After analyzing the factors affecting the competitiveness of the port, it is particularly important to conduct a comprehensive evaluation of the port competitiveness. In terms of port competitiveness evaluation, indicators of port competitiveness measurement and evaluation gradually expanded from port facilities development to traffic level, labor cost, port accessibility and other factors (Kenyon, 1973; Foster, 1978; Hoare, 1978; Haynes, 1997). Further, on the basis of summarizing the above theoretical indicators, Wu (2005) established a comprehensive evaluation index system for port competitiveness, which refers to the external environment, hinterland traffic conditions, port rates and port operation efficiency. In addition, some social factors such as technology and policy (Wei, 2006; Lam, 2006), port location, port charges, port equipment, shipping services, terminal operators, port information systems, hinterland connections, customs and government Regulations (Yuen et al., 2012) are gradually being included in the category of indicator systems for port competitiveness measurement and evaluation.

With the development of the economy, people's demands and understanding of environmental protection are constantly improving. How to maintain sustainable economic development under green and low-carbon conditions has become the focus of scholars' research. Therefore, a comprehensive consideration of port competitiveness from the economic, social and environmental aspects (Asgari et al. 2015) has become another research perspective in the current academic community. Representatives such as Asgari et al. (2015) used the Analytic Hierarchy Process (AHP) to construct indicators for sustainable development of UK ports from the economic, environmental and social aspects. It can be seen that the evaluation index system of foreign port competitiveness has gradually expanded over time: from a single indicator to a multi-indicator system, from a single perspective to multiple perspectives, from internal factors of the port to external conditions and other social factors.

Domestic researchers are lagging behind abroad on the measurement of port competitiveness indicators research. Zou (1998) and Zeng (2008) based on the two categories of hard power and soft power evaluation indicators, used TOPSIS, AHP and other methods to evaluate the integration of Asian ports such as Hong Kong Port, Busan Port, Kobe Port,

Singapore Port and Shanghai Port, compared Shanghai and other major Asian ports in hard power and soft power from horizontal comparison.

Table 2-2 Different indicators on port competitiveness evaluation index system

Indicators	References
natural geographical conditions	Ma(2007); Zheng(2008); Wu et al.(2015)
port infrastructure	Ha(2003); Ma(2007);Zheng(2008); Yu et al.(2011); Wu et al (2015); Teng and Hu (2017); Li (2017); Wei and Hu (2017); Zhao and Shou (2018)
Collection and distribution system	Zheng (2008); Yu et al. (2011); Teng and Hu (2017)
Route density	Jose(2005)
Throughput of containers, goods or international trade	Zheng (2008); Yu et al (2011); Teng and Hu (2017); Li (2017); Tang et al (2017); Wei and Hu (2017); Zhao and Shou (2018)
Port operation efficiency	Haynes(1997), Notteboom (2000); Jose (2001, 2005)
Port management level	Ma (2007); Wei and Hu (2017)
Port service level and quality	Ma (2007); Zheng (2008); Wu et al (2015)
Port development potential	Teng and Hu(2017); Li (2017); Wei and Hu (2017)
Goods type and structure, innovation ability	Zheng (2008)
Logistics information system, related industry support, laws and national preferential policies	Ma (2007)
Financial status	Wei and Hu(2017)
Hinterland economy (city) development	Jose (2005); Zheng (2008); Yu et al (2011); Wu et al (2015); Teng and Hu (2017); Li (2017); Wei and Hu (2017); Zhao and Shou (2018)

Li et al. (2009) pointed out that depending on the geographical location and natural conditions, the port infrastructure is perfect, the port service level and operational capacity, the level of port modernization and sustainable development capacity constitute the competitiveness evaluation indicators of China's domestic river ports. On this basis, Huang et al. (2017) constructed a green evaluation index system of port competitiveness. The first-level indicators mainly include the following five items, infrastructure, production operation scale,

cost control, logistics influence and pollution control. They believe that there is an interdependent network structure relationship among the green port competitiveness evaluation indicators. For this reason, the previous evaluation methods may have deviations in the determination of index weights, so the Analytic network process (ANP) is adopted.

Since the factors affecting the competitiveness of the port involve various aspects, different scholars use different methods and indicators to evaluate port competitiveness from different dimensions and different aspects. Therefore, in addition to the above scholars' research, other scholars have also adopted indicators for evaluating port competitiveness such as natural geographical conditions, port infrastructure, port management level, port service level and quality, related industry support, legal and national preferential policies, logistics information systems, and port operation efficiency, collection and distribution systems, and container, cargo or international trade throughput, route density, hinterland economic (urban) development, and port development potential, cargo structure, innovation capacity and financial status. The details are shown in Table 2-2.

2.1.2.3Port competitiveness measurement and evaluation method

The research on the measurement and evaluation methods of port competitiveness in international academic circles is relatively mature. The survey analysis method, AHP method, discrete selection model, Logit model and Porter model are used to evaluate the port competitiveness. Specifically, the first is to evaluate the port competitiveness based on the survey or questionnaire analysis method, and to measure and evaluate the port competitiveness based on the questionnaire research method. The second is to use the Analytic Hierarchy Process (AHP) to measure and evaluate port competitiveness. This type of research is relatively abundant. For example, used the AHP method to establish the port sustainable development evaluation indicators from the economic, environmental and social aspects, it is a more detailed evaluation and ranking study on the competitiveness of the British ports (Asgari et al., 2015).

The AHP method is used to comprehensively evaluate the port competitiveness of Cameroon's Douala port, West Africa and other ports in Central Africa, and to compare and analyze the advantages and disadvantages of Douala port competitiveness and port

competition in other regions (Balla, 2016). In addition, the measurement and evaluation of port competitiveness using the AHP method involves Lirn et al. (2003), Song and Yeo (2004), Ugboma et al. (2006), Lin and Tseng (2007), Chang et al. (2008). The third is to use the discrete selection model (Malchow & Kanafani, 2004), multiple Logit models (Malchow & Kanafani, 2001) and other quantitative regression models to measure and evaluate port competitiveness. In addition, some scholars applied the Porter Diamond model to evaluate the port competitiveness (aezendonck et al., 2000). It can be seen from the above studies that the methods used by international scholars to evaluate port competition are relatively concentrated in the application of Analytic Hierarchy Process (AHP), but it is not limited to this.

In China, scholars mainly adopt principal component analysis methods in measurement and evaluation(Guo & Huang, 2015; Zhou, 2017; Zhao & Shou, 2018), cluster analysis method (Zhou, 2017), analytic hierarchy analysis Law (Ma, 2007; Qu et al., 2014; Li, 2017), Fuzzy Comprehensive Evaluation Method (Wang & Xiao, 2006; Ma, 2007; Li, 2017), DEA (Zheng, 2008; Liu et al., 2013; Teng & Hu, 2017; Wei & Hu, 2017; Wang, 2018), TOPSIS method (Kuang & Chen, 2007; Teng & Hu, 2017; Wei & Hu, 2017), Factor analysis methods (Lv et al., 2011; Yu et al., 2011, Wang and Han, 2012; Li, 2017), cloud model evaluation method (Wu et al., 2015) and other evaluation methods evaluate port competitiveness.

Looking at the literature on the measurement and evaluation of port competitiveness, it can be seen from the perspective of the port competitiveness evaluation index system that the traditional port competitiveness evaluation index system only includes indicators of economic dimensions such as port input and output, and lacks indicators on energy consumption, efficiency dimensions such as pollutant discharge and environmental control in ports; As an important indicator to measure the performance of port development, port efficiency can reflect the optimization of port resource allocation, and it is the overall reflection of port input and output capacity, competitiveness and management level. Port efficiency is the main core indicator of port competitiveness evaluation. In line with the development trend of modern logistics industry; from the perspective of port competitiveness evaluation methods, the evaluation methods used by scholars are mainly factor analysis method, entropy weight

method, fuzzy evaluation method, AHP method and DEA method(see table 2-3). These methods have their own advantages, of which factor analysis is the most widely used. However, the factor analysis method has no significant effect on the evaluation of mutual influence between the same level factors and adjacent levels.

Table 2-3 Evaluation methods of port competitiveness

Evaluation methods	References
Factor Analysis	Wang (2006); Lu et al (2010); Yu et al. (2011); Wang and Han (2012); Qu et al (2014); Li (2017)
Porter diamond model	Haezendonck et al.(2000)
Cluster analysis	Zhou (2017)
Entropy weight fuzzy comprehensive evaluation	Wang and Xiao (2006); Ma (2007); Li (2017)
Entropy weight method and TOPSIS	Yan and Chen (2007); Teng and Hu(2017); Wei and Hu (2017)
Malmquist of DEA	Zheng (2008);Liu et al (2013); Teng and Hu (2017); Wei and Hu (2017); Wang (2018)
Principal Component Analysis	Guo and Huang (2015), Zhou (2017), Zhao and Shou (2018)
AHP method	Lirn et al. (2003); Song and Yeo (2004); Ugboma et al. (2006); Lin and Tseng (2007); Ma (2007); Chang et al. (2008); Qu et al (2014); Asgari et al. (2015);Alla (2016); Li (2017)
TOPSIS method	Teng and Hu (2017)
Cloud model evaluation	Wu (2015)
Discrete selection model or logit model	Malchow and Kanafani (2001，2004)

2.1.3 Port efficiency and measurement

From the definition or connotation of port efficiency at domestic and abroad, one view holds that port efficiency is an overall reflection of port resource allocation, input-output capability, competitiveness and management level (Pang, 2006; Zhang & Deng, 2013). In terms of connotation, port efficiency includes internal port operation efficiency, network efficiency between port and port, and radiation efficiency of port to hinterland economy

(Deng, 2012; Zhang et al., 2013). Another view is that port efficiency includes both macro and micro levels. At the macro level, port efficiency refers to the contribution rate of ports to national economic growth; at the micro level, port efficiency refers to the optimal degree of resource allocation achieved by each port. Specifically, it includes technical efficiency, cost efficiency, and configuration efficiency (Tong, 2001; Yan, 2007). From the above definition or connotation of port efficiency, it can be seen that no matter in terms of three levels of port efficiency or from technical efficiency, cost efficiency and allocation efficiency, the improvement of port efficiency is beneficial to the judgment of ports. The gap between the efficiency level of itself and other ports is conducive to optimizing the allocation of port resources and providing a basis for the port to cultivate its core competitiveness (Luo et al., 2013). With the deepening of the international division of labor and the further development of economic globalization, port efficiency has increasingly become an important measure of port competitiveness (Zhang et al., 2013). It can be seen that port efficiency has gradually gained attention as the main core indicator of port competitiveness measurement. From the research purpose, the port efficiency of this study is the definition of port efficiency at the micro level.

The early research on port efficiency mainly focused on the connotation of port efficiency, the evaluation index of port efficiency and the evaluation method. Scholars often use a single indicator to evaluate port efficiency, such as port efficiency by port cargo efficiency (Bendall & Stent, 1987), and port efficiency is assessed by port's total factor productivity indicator (Kim & Sachish, 1986). With the deepening of research, scholars have found that due to the complexity of port operations, the port is a multi-input, multi-output management system. A single indicator cannot accurately and comprehensively evaluate port efficiency. More and more scholars have begun to study more and introduce multiple indicators such as port cargo throughput, port service level, user satisfaction, ship work efficiency, container quantity, and port profit into the port efficiency evaluation system index. Liu (1994) made a relatively comprehensive summary of this, from the perspective of port input and port output, using multiple indicators to comprehensively reflect port efficiency, and established a multi-indicator port efficiency evaluation model: data envelopment analysis and

factor analysis model. DEA is an efficiency evaluation method based on the concept of relative efficiency. It is a special tool based on linear programming for evaluating the relative effectiveness of work performance of the same type of object. Therefore, in recent years it has been widely used in port efficiency measurement. Tongzon (2001) proposed the relevant indicators for DEA port efficiency evaluation contains the number of cranes, the number of container ships, the number of tugs, the airport area, the waiting time of ships, the number of employees in Hong Kong, the throughput of goods, and the efficiency of ship work. Valentine Gary (2001) proposed the DEA evaluation of port efficiency from the perspective of port efficiency carrier-ship, they are the total length of the ship, length of the container ship, number of containers, total throughput. Teng-Fei (2003) proposed evaluation indicators from the perspective of port supporting hardware facilities: terminal length, airport area, number of bridge cranes, number of stack cranes, number of cross-loaders, and port throughput. Roll and Hayuth (2003) proposed DEA measurement indicators that affect port efficiency: human resource cost, single attribute of goods, cargo throughput, port service level, user satisfaction, ship machinery call frequency.

In summary, the DEA port efficiency evaluation indicators commonly used by international scholars include cargo throughput, human resource cost, port hardware facilities conditions, and route connectivity conditions. On the basis of international scholars' research, Chinese scholar Pang (2006) used data envelopment analysis analyzed and evaluated the port efficiency of 50 major ports in China and used the Malmquist productivity index to analyze and evaluate the port efficiency changes of these coastal ports. The research results show that China's coastal ports operation efficiency is generally not high, regional differences are significant, port congestion and resource waste are serious, and port competitiveness needs to be improved. Luo et al. (2013) used the DEA-Tobit two-stage method to evaluate the port efficiency of China's eight major ports during the seven years from 2003 to 2009, and to analyze the main external operating environment elements of port efficiency. Zheng (2014) based on the panel data of China's 16 listed port companies from 1998 to 2011, using the input distance function method to empirically analyze the port efficiency of China's ports from technical efficiency, allocation efficiency and production efficiency three levels. Ren

(2011) used the principal component analysis method to evaluate the overall competitiveness of Liaoning coastal economic belt by establishing a reasonable index system, and substituting the calculation results into the DEA method to evaluate the port efficiency, and found that the port of Liaoning coastal has higher economic belt efficiency, but still has room for improvement. Deng (2011) decomposed the connotation of port efficiency into transportation hub, processing and loading, logistics service and resource allocation four levels, and established the corresponding DEA port efficiency evaluation index system to measure the port efficiency level of six countries. The results show that the port efficiency of Chinese ports is lower than that of the world's major port countries such as Germany, the United States, the Netherlands, and Singapore. It also proves that the port efficiency is significantly positively correlated with the total international trade under other conditions. Zhu (2017) used the ultra-efficient DEA window method to measure the port efficiency of the seven ports in China's Pilot Free Trade Zone from 2009 to 2014 and used the Malmquist index to analyze the main reasons for the differences in port efficiency.

In summary, at present, scholars at home and abroad mainly define port efficiency evaluation indicators from the aspects of technology, configuration, scale and cost, and use the DEA method to measure port efficiency levels, and the research results are relatively mature. On this basis, this study selects six variables such as port facility conditions, route connectivity conditions, port operation efficiency, port competitiveness, institutional environment, and port throughput. DEA method was used to quantitatively evaluate the port efficiency of Guangxi Beibu Gulf Port. Systematically reveals the port efficiency of the Guangxi Beibu Gulf Port in multi-layer interactive economic linkages such as port operations, ports, ports and inland hinterland, and then proposes countermeasures for the competitiveness of Guangxi Beibu Gulf Port.

2.2 Resource theory and port competitiveness

2.2.1 Overview of resource theory

Generally, we collectively refer to various material elements such as human, material, and financial resources in a country or region as resources. Natural resources such as water, air, forests, animals and minerals that are in contact with and used in social and economic activities, as well as economic resources such as human resources, information and material wealth, are all belong to the category of resources. However, resources in economics have broad and narrow meanings. Broadly resources include natural resources, endowments, physical capital, technological progress, public order, law, beliefs, and values. Narrowly resources refer to natural resources, especially concentrated resources such as minerals, oil, and natural gas in nature (Zeng, 2012).

The definition of resources in the academic world is different from the discussion of resources in real life. The early germination of resource theory came from the basic idea put forward by Selznick (1957) that “the resources of each company are different”. This concept later became part of the classical strategic theory school, such as the corporate strategic analysis framework proposed by Andrews (1971) and Ansoff (1965). Penrose (1959) officially stated that the enterprise is regarded as a collection of specific resources, and the heterogeneity of its own resources has given each enterprise its unique characteristics and become the source of its competitive advantage. It is also considered that resources are the physical objects purchased, leased or manufactured by a company for its own use and the labor employed under certain provisions which can make the labor effectively become part of the enterprise resources. These views also laid the foundation and created a precedent for the development of the Resource-Based View (RBV) in the future. Following Penrose's (1959) study, Wernerfelt (1984) further defined the concept of resources as a collection of all tangible and intangible assets of an organization for a certain period of time, including brand, technical knowledge within the organization, trade, machines, efficient programs and capital. From a resource perspective, he analyzes companies that implement differentiated strategies through creative resource sets (tangible and intangible resources) and operational activities to gain

competitive advantages that competitors are difficult to replicate (Wernerfelt, 1984; Wen Xiao & Liu, 2007) and it is applied to corporate strategic decisions. Since then, the resources-based view has been officially proposed by Wernerfelt (1984). RBV replaces “products” with “resources” and considers that enterprises are a unique combination of tangible and intangible resources, rather than product marketing activities. This is important for companies to analyze corporate strategic decisions from the perspective of “resources” rather than “products”. On the one hand, the concept of resource-based view has turned people's habitual strategic thinking of enterprises from the concept of "product" to the concept of "resources", so that the basis of enterprise strategy formulation is gradually shifted from external "industry structure analysis" to "inner resources and capability analysis."

On the other hand, RBV is seen as an important bridge connecting the capabilities of enterprises with the external environment (Huang & Cheng, 2005). The resource-based concept is the main point of RBV: First, the enterprise is a collection of resources and capabilities, and any enterprise has unique resources that are different from other enterprises. Second, when analyzing the competitive strategy of the enterprise, the competitive advantage of the enterprise should be examined from the internal resources of the enterprise. Third, RBV is not simply analyzing enterprises through production and marketing activities of enterprises but analyzing the competitive advantages of enterprises from tangible and intangible resources. From this we can see that the competitive advantage of an enterprise depends on the tangible and intangible unique resources that the enterprise itself constructs, nurtures and possesses (Ge and Xiao, 2007).

Barney (1986) further expanded on the basis of the resource-based concept proposed by Wernerfelt (1984). When he studied the competitive advantage of enterprises, he found that enterprises can accumulate and cultivate their own resources, forming a long-term and sustainable competitive advantage. Barney (1986) pointed out that companies have a sustainable competitive advantage because they can obtain low-cost, high-output strategic resources through the imperfectly competitive factor market. These strategic resources can play a fundamental role in the competition and create significant contributions. Therefore, Barney (1986) believes that the main reason for the difference in competitive strategic

performance between enterprises lies in the quantity, quality and operation efficiency of resources owned or controlled by enterprises. Further, Barney (1991), through systematic and in-depth analysis, proposed that firm resources may be heterogeneous and immobile; and not all firm resources hold the potential of sustained competitive advantages. To have this potential, a firm resource must have four attributes: (a) it must be valuable, in the sense that it exploit opportunities and/or neutralizes threats in a firm`s environment, (b) it must be rare among a firm`s current and potential competition, (c) it must be imperfectly imitable, and (d) there cannot be strategically equivalent substitutes for this resource that are valuable but neither rare or imitable. Only the tangible or intangible resources owned by enterprises have the above several characteristics, which can make the competitive advantage of enterprises have certain sustainability.

Many scholars have different understandings of resource forms, such as patents, property rights, monopoly advantages and social relations. (Prahalad & Hamel, 1990; Conner, 1991; Fiol, 1991). Most scholars claim that only intangible resources such as brand value and corporate reputation can create higher performance, so only intangible resources are the source of competitive advantage (Galbreath & Galvin, 2006; Wang & Kandampully, 2006). Another view is that there may be some kind of interrelationship between resources. The emergence of one resource advantage may depend on the existence of another resource, so any single resource cannot be called so-called enterprise performance source alone (Möller & Svahn, 2003).

Grant (1991) puts forward the "Resource-Based Theory (RBT)" after summarizing the related views of Penrose (1959), Wernerfelt (1984) and Barney (1986, 1991). The RBT's claim to “internal review” is the importance of resource-based theory. Similarly, the focus and core of competitive strategy theory research is gradually shifted from “industrial structure analysis” to “inner resources and capability analysis”, and it is considered that the difference in resources is an important reason for the different profitability of enterprises.

At the same time, the theory holds that internal resources of enterprises will guide the development direction of corporate strategy and become the main source of corporate profits. The significance of RBT lies in finding the root cause of the competitive advantage of the

company in the product market from the internal resources of the enterprise rather than the environmental conditions outside the enterprise. Its application value is to enable managers to focus on the strength of the enterprise itself, to help managers identify resources that can generate sustainable competitive advantage, and to advise them to develop corporate strategies and make decisions from a resource perspective. The formal establishment of the theory provides a new perspective and thinking for strategic leadership, strategic decision-making and knowledge-based theory.

2.2.2 Existing research on resource theory in port economy

The perspectives of resource-based view (RBV) and resource-based theory (RBT) from Penrose (1959), Wernerfelt (1984), Barney (1986, 1991), and Grant (1991), focuses on the internal resources, knowledge and capabilities of enterprises to influence the competition of enterprises. The source or key to a company's competitive advantage is the heterogeneity or irreplaceability strategic resource that the company has. With the increasing competition in various industries, the external environment of enterprises is becoming more and more complex. How to maintain or enhance the competitive advantage of enterprises has become a major problem facing the development of enterprises. Since the resource theory focuses on the “internal review” of the enterprise, it provides a useful tool for the establishment or maintenance of competitive advantage. Therefore, resource theory is widely used in the research of corporate or industry competition strategies.

As a product of global economic integration and the globalization of trade globalization, the port economy has gradually appeared in the regional or urban economic development, which has attracted wide attention of scholars. However, before the 1990s, in addition to general basic research, port managers rarely developed their strategies by assessing their strategic planning frameworks to assess or evaluate their long-term planning goals (Frankel, 1989). In recent years, the increasingly complex environment has led the port sector to examine port development issues from a resource perspective in order to serve strategic planning (Coeck et al., 1996). Since then, the resource-based view has been further developed.

With the expansion of the research framework and the development of research tools, the RBV is increasingly mature for in-depth analysis of port economies and port strategies (Haezendonck, 2001). Haezendonck (2001) believes that when analyzing the strategic positioning of a port, the researcher should combine the unique advantages of the port, that is, the resource base of the port. Dooms and Macharis (2003) proposed a conceptual framework for inland port planning based on resource-based theory, taking into account the preferences and goals of all short-term and long-term stakeholders to achieve sustainable port development. The framework takes into account the specific spatial, socio-economic and regulatory characteristics of the port's natural resources, hinterland infrastructure, economic conditions and port authority, and studies the development strategy of the entire port area with the aim of long-term planning. Franc and Horst (2008) studied the integration of the hinterland service of the Hamburg-Le Havre shipping company and the terminal operator. Studies have shown that transaction cost economics and resource-based perspectives help explain why shipping companies and terminal operators expand their reach in multimodal and inland terminals. In order to address some of the limitations of these theories, Franc and Horst (2008) induce (1) geographic scale; (2) company development and (3) local parameters such as institutions and environment into the analytical framework to deepen the analysis. Cho and Ha (2009), taking Pohang Port in Korea as an example, based on resource-based perspectives and institutional theories, studied the determinants of FDI inflows in regional ports, and concluded that resources such as free trade zones, industrial clusters, and information and communication technology infrastructure are the main determinants which attract multinational corporations.

More and more scholars in China have begun to apply resource theory to the relevant research of port economy, in order to analyze the strategy of maintaining the competitive advantage of enterprises from the perspective of the organization's internal resources. For example, Xu (2006) applied the relevant viewpoints of resource theory to the concept of port core competitiveness. He defined the core competitiveness of the port. The organic combination of technologies, skills, knowledge and capital provide port competitive advantages. These combinations can enable the entire enterprise to maintain long-term

competitive advantage and obtain excess profits (Xu, 2006). Wang et al. (2008) not only pay attention to the port loading and unloading energy consumption, port energy consumption, but also the port's production capacity and operation efficiency when studying the coordinated development of port and urban environment and resources. Examine the coordination between the port and the urban environment and resources from the perspective of the port and the enterprise itself. Researchers (Yang & Pan, 2011; Pan et al., 2012) construct a resource system from the perspective of resources, and study the port's own resources such as the number of dock berths and the load of the terminal shoreline resources), connected the port system, economic system and population system through the mediating variable of port throughput, which further acts on the effect of the coupling of the entire port city. Si (2012, 2015) research shows that cities with faster port infrastructure construction and urban economic development are also faster. However, there are differences in the nature of port infrastructure associated with port cities. The reason for this difference is that there are differences in the infrastructure of different ports, and heterogeneity exists in different port cities. Song et al. (2007) included relevant indicators such as total port profit, port berth, port infrastructure construction investment, and port storage area into port economic efficiency accounting when accounting for port economic efficiency.

After decades of development, resource theory has gradually matured and applied to various fields. In the study of ports and their economies, Chinese scholars have gradually shifted from focusing on the external environment to the external environment and internal resources of the enterprise, and exploring port infrastructure, port operation efficiency, production capacity, and port operation efficiency.

2.2.3 Port resources and port competitiveness

2.2.3.1The relationship between resource theory and port resources

From the overview we know that resource theory is mainly the theory and doctrine including related theories such as Resources-based View RBV and resource-based theory RBT. It advocates the unique heterogeneity and non-mobility resources of enterprises, it is the source of enterprises profits, and the foundation for enterprises to establish or maintain

sustainable competitive advantage. The resources mentioned here are mainly material resources such as plant and equipment, human resources such as experience, judgment and relationship and organizational resources such as formal and informal planning, control and synthesis systems (Barney, 1991) and production processes, trademarks, patents and know-how. These are all areas of resources (Oliver, 1997) which involve all main aspects of the company.

Cho and Kim (2015) pointed out that some research on resource theory only stays on the surface of the theory. It is necessary to deeply study the competitive advantages of container ports, make full use of port resources, and also understanding resource theory from different levels. They think that ports have different levels of resources, such as equipment, infrastructure and operational systems. The status of these resources can be used as an indicator of port capacity. Ports that use different resources can gain different advantages. As with any industry, competitive resources play an important role in the maritime industry's competition to acquire and protect container transport. Container ports can utilize a variety of resources, such as port infrastructure, to gain market share and customers. While using tangible resources, intangible but important resources such as linear shipping connections and operation efficiency are also important for port competitiveness. Cho and Yang (2011) empirically analyzed the impact of container throughput, globalization, information and communication technology, innovation capability and institutional impact on port competitiveness based on resource theory and institutional theory. It is found that the globalization process, the interaction between the globalization process and the institutional environment, and the interaction between the innovation and the institutional environment have a significant negative impact on container throughput, and do not support the original assumption; information and communication technology, innovation and information and communication and the interaction between technology and institutional environment has a significant positive impact on container throughput, supporting the original hypothesis.

Sun (2006), Sun and Pan (2007) and Wang (2008) defined the meaning of port resources when studying the integration of China's port integration resources. They believe that the port resources in a broad sense are the resource conditions or elements of the port. Specifically, it

includes tangible entity resource elements, intangible skill resource elements, customer resource elements, and information resource elements. Such as port facilities, shoreline resources, freight organization, management experience, shipping companies, ports and terminals are all port resources. It can be seen that, in a broad sense, port resources cover a wide range, including not only water resources, financing capacity, shoreline resources, but also the flow of goods, equipment, ships and personnel. Port resources in the narrow sense refer only to physical resource elements such as shoreline resources and port facilities.

It can be seen that port resources include not only port infrastructure, equipment, management concepts, route routes, personnel, but also natural resources such as water resources and terrestrial resources. However, from the academic field's measurement of port resources and related research, it mainly focuses on port infrastructure resources such as berth length and berth number (Pang, 2006), shoreline, anchorage and navigation channel (Zhao & Zhen, 2015), docks, trunk roads and railways (Zhu & Guo, 2005a; 2005b), this is a narrow category of port resources, and it is precisely an important part of the "resources" that constitute the theory of resources.

2.2.3.2 The relationship of port resources and port competitiveness

From the related concepts and contents of port competitiveness and port resources, port competitiveness is based on various resource elements such as ports, shorelines, berths and waterways, and optimizes the allocation of various resources and production factors. Promoting the development of all aspects of the port, and has a certain comparative advantage compared to other ports. Therefore, having a unique or heterogeneous port resource and maintaining a certain competitive advantage is a prerequisite for the port to be competitive and whether the port is competitive in the same industry or the strength of the port competitiveness is the specific performance of the port resource collection. In other words, in general, compared with other ports, the more unique and heterogeneous resources a port has, the greater the overall competitiveness of the port, and vice versa.

Ma (2007) pointed out that the internal and external factors of port natural conditions, port hardware infrastructure, information resources and other factors are positively related to port competitiveness. Zheng (2008) pointed out that the competitive advantage of resources is

an important aspect of port competitiveness when studying the competitiveness and evolution of China's ports. Natural resources, economic resources, infrastructure, collection and distribution systems, service systems and soft resources together constitute a competitive advantage of resources. Yu et al. (2011) and Wu et al. (2015) found that port resources such as port natural conditions, port infrastructure, and port service levels are among the important factors affecting the competitiveness of cruise ports. Li (2017) research shows that natural conditions such as geographical location, infrastructure such as number of berth and length of terminal coastline, operating environment such as flight density, operational capacity such as loading and unloading efficiency and passing costs, soft resources such as informationization degree. Important factors for port competitiveness: The better the geographical location, the better the infrastructure and business environment, and the more flexible resources, the stronger the competitiveness of its container ports. Li (2017) conducted research on the competitiveness of China's ports and found that high-level infrastructure conditions and abundant shoreline resources are the basis for the healthy development of the port. Similarly, other scholars have drawn port infrastructure (Teng & Hu, 2017; Zhao & Shou, 2018), port management level (Wei & Hu, 2017), port financial status such as operating income and total profit (Wei et al., 2017) have positive correlations with the logical principles and empirical evidence of port resources and port competitiveness.

2.2.4 Port resource measurement

Port resources are a collection of resources. When measuring port resources, using a single indicator to measure is obviously not able to accurately port resources. Therefore, the measurement of port resources should be a comprehensive system composed of many indicators to reflect the resource status of the port.

Resource theorists' indicators of port competitiveness have a great influence on modeling and research results, and different scholars have different measurement priorities. Pearson (1980), Willingale (1981), Collison (1984) and others found that port location, port throughput and port connectivity conditions are the three most important factors. Lirn et al. (2003, 2004), Tai and Hwang (2005) and others have shown that the geographical location of

the port and the distance from the hinterland are important resource conditions for determining the competitiveness of the port. Fleming and Baird (1999) pointed out that accessibility conditions such as port throughput, hinterland-to-port transportation facilities, and port terminal berths are important resources that affect port competitiveness.

At present, the evaluation indicators of the port system are divided into two categories, one is efficiency and the other is effectiveness. Port performance indicators include input/output performance of ship, terminal and container freight station subsystems; efficiency measures include congestion, ship waiting time, waiting time factor, average ship time and total port cost (Huang, 1997). Teng and Huang (2004) used gray correlation analysis to select data from eight ports including Singapore, Hong Kong, Kaohsiung, Kobe, Taichung, Keelung, Busan and Shanghai to study the improvement of port competitiveness. The study concludes that to improve port competitiveness should from labor quality, financial liberalization, political, social and economic stability level, hinterland productivity, average port arrival time, loading and unloading ratio, transportation capacity during the period, carrier operating costs, port service fees, customs services Level and inbound/outbound ratio indicators.

Cho et al. (2015) believe that the difference in port resources between different countries or regions is the reason for the differences in their port competitiveness. The container port has a competitive advantage, which is mainly caused by the unique and heterogeneous port resources and their different efficiency. Ports in a country or region have a variety of resources, such as equipment, infrastructure, and operational systems. These tangible and intangible resources can be important aspects that distinguish them from other ports and have a competitive advantage. Therefore, various tangible and intangible resources have become an important indicator of port competitiveness. Therefore, Cho et al. (2015) select the route number, the number of companies, the ship throughput and other indicators to measure the conditions of the route and select the profit growth rate / cost growth ratio to measure the port operation efficiency.

Domestic scholars have constructed different indicator systems from different perspectives for measurement. For example, Zhu and Guo (2005a, 2005b) perform

quantitative analysis in the quantitative evaluation of port resources from hydrology (tidal type, tidal range and wind waves), meteorology (including annual average rainfall days, rainfall and annual average temperature), Establishing an indicator system for water and land resources (including shoreline conditions, length of channel, number of dock berths and anchorages) and geographic location (including number of trunk roads, number of railways and river capacity). Zhao and Zhen (2015) used the indicators such as the length of the shore production line, the designed channel passage capacity, the anchorage area, and the port operation production cost as indicators for measuring port resources, port cargo throughput, pilot vessel ships, and ports. The enterprise production profit and other indicators are used as the output indicators of port resources to analyze the port resource integration. When Zhao and Zhen (2016) studying the decision-making mechanism of port niche resource integration, they measure natural resources by means of indicators such as waterway, anchorage and shoreline, and measure the market resources by means of the hinterland index, measuring social and economic resources with capital, policy and organizational resources.

2.3 Hypothesis on port competitiveness and port resources

The research on port competitiveness has been long. And the preliminary research mainly studied the relationship between port and ship transportation as a part of shipping economy. In the 1960s, systematic research on port development and more in-depth research on port competitiveness appeared. Research on the relationship between port competitiveness and port resources has different concerns in different periods of port development.

2.3.1 Relationship between port competitiveness and port facilities conditions

In the initial stage of port development, the port's openness is not high, mainly based on domestic trade. The port has a single functional structure, and the port's own facilities are the key factors determining the port's competitiveness. Port facilities include the location of the port, the length of the shore production line, the design of the channel passage capacity, and the anchorage area. In the initial stage of port development, the number of ports is small, the state has limited investment funds, the port operation technology is relatively backward, and

the ship's speed is slow. Therefore, the geographical location of the port and the port's own conditions are undoubtedly the key factors affecting the port's development. Many scholars have proved this when evaluating port competitiveness. Singapore Port ranks top among the world's largest ports with its excellent geographical position and good conditions. Further, taking Singapore Port as an example, it is found that port geographical location, water depth conditions, government support, adequate investment, reasonable port operation and information technology have a significant impact on port competitiveness, which is based on the resource advantage of port competitiveness (Gordon et al., 2005). Most of the research on port competitiveness evaluation focus on the relationship between port facilities conditions and ort facilities conditions are indispensable indicators for evaluation. Yan (2004) used the fuzzy comprehensive evaluation method to evaluate the competitiveness of container ports, selecting geographical location conditions and hinterland supply, hardware and software facilities, operation efficiency, port costs, port development and operation management methods, overall development, and micro strength, macro environment and other aspects as reference evaluation indicators. Sun (2004) also considered the infrastructure conditions when evaluating the competitiveness of Dalian Port, and analyzed the influencing factors. Other scholars have found that the geographical location factors of the port, the comprehensive scale of the port and the city, the background of international trade, the port infrastructure and efficiency have obvious influences (Xu Yanqing, 2016) on the spatial change of the port-Hinterland. It can be seen that although port facilities are an important part of port resources, in the existing related research, most of them directly use port infrastructure as one of the evaluation indexes of port competitiveness and study the influences of port infrastructure to port competitiveness. This research analyzes the impact of port infrastructure on the competitiveness of the Beibu Gulf port from the perspective of resource theory. Therefore, based on the above discussion, this study proposes the following hypothesis:

Hypothesis 1: Port facility conditions are positively correlated to port competitiveness in Beibu Gulf port.

2.3.2 Port competitiveness and port connectivity conditions

With the development of international trade, the port has been continuously opened to the outside world, the number of international shipping ports has gradually increased, and ship and port operation technologies have been continuously updated. More and more scholars believe that port connectivity conditions are an important factor in port development. The port's connectivity conditions include the number of routes, route density, and collection and distribution systems. In 1957, Mayer pioneered the land-to-ground competition between ports. Subsequently, Weigend (1958) analyzed the sea-to-ground competition between the ports and the water-port-land joint advantages. In the 1970s, Kenyon et al. extended the perspective of port competition analysis to factors such as labor cost, productivity, rail transport convergence, port accessibility, and land use. Subsequent research found that some service factors, such as the number of routes, flight density and service quality, service convenience port congestion and port rates affect the ship's choice of port, which is far more important than the port and the ship distance (Foster, 1978). Van de Voorde (2002) and Claudio Ferrari et al. (2006) consider that the route is an important factor that the ship often considers when selecting the port. The distance between the sea direction and the land to the hinterland should also be an important factor affecting the competitiveness of the port. (Malchow & Kanafani, 2001). Haezendonck (2000) found that the transport patency, productivity level, product quality, cargo structure, port reputation and reliability of the hinterland are important competitiveness indicators. The higher the level of these indicators, the stronger the port's ability of attract goods. Yao (2011) proposed the evaluation system of the competitiveness of the port city from the perspective of the joint development of the port city, consist the scale of the collection and distribution facilities, the scale of the city's economy, the scale of opening up and the size of the employed population 5 first-level and 25 secondary indicators, and used the factor analysis method to analyze the Rizhao Port as an empirical analysis, which proves the validity of the model. Dong (2011) studied the route coordination capability between different ports and the channel capacity within the port and the inland. And believed that the overall efficiency of the transportation supply chain depends on the most vulnerable connections or nodes, and the impact of the port-inland corridor on

port competitiveness is analyzed in depth. Zhang and Wang (2013) found the role and status of ports in modern trade is not determined solely by the port itself. The upstream and downstream enterprises related to the port will also have a non-negligible impact on the port, which should be taken as a whole from the supply chain perspective. And this study proposed the impact of the logistics enterprises, shipping companies and port service departments of the port on the port competitiveness. Li (2017) think whether the communication between the ports and the outside world is smooth is another important condition for the port to attract shipping companies. The collection and transportation situation is excellent, the transportation is convenient, the land to the hinterland is wide, and the railway equipment is perfect and reasonable, then the comprehensive competitiveness of the port is stronger. According to the review, port competitiveness and the number and density of port routes, collection and distribution systems and logistics companies are closely related to port connectivity. Therefore, this study proposes the following hypothesis:

Hypothesis 2: Port connectivity conditions are positively correlated to port competitiveness in Beibu Gulf port.

2.3.3 Port competitiveness and port operation efficiency

With the large-scale ship and the ship technology continuous development, the ship's speed has been continuously improved. The development of multimodal transport extends the scope of port enterprise services. The geographical advantage of the port has been diluted within a certain range of mileage. The distance is not the primary factor influencing the choice of shippers, and the operation efficiency of the port is crucial. Scholars have focused their research on port competitiveness on the operation efficiency of ports. Jamaluddin et al. (1995) emphasized the importance of port freight, safe handling of goods, confidence in port dispatching and port services to port competitiveness. Chiu (1996) pointed out that customs services, processing speed, streamlining port documents, reducing cargo losses, and port labor skills will also affect port competitiveness. Haynes et al. (1997) believe that efficiency is one of the important factors affecting port competitiveness. The key factor for Hong Kong Port and Kaohsiung Port to have a large container throughput is that the two ports serve as trading

centers for regional distribution networks with high efficiency. High efficiency is the potential of port development. By selecting the port data of Hong Kong and Kaohsiung, empirical research has found that efficiency has become one of the most important factors affecting port competitiveness, and that efficiency must be considered as a criterion when evaluating port competitiveness. Fleming (1997) pointed out that meeting the requirements of shipping companies with various modern facilities and services can maintain its competitive advantage. As the main hub port of South Korea, Busan Port has attracted many Chinese and its pursuit of cost advantages and implementation efficiency strategies in recent years. In Japan's container transportation, Busan Port has expanded its hinterland from South Korea to North Asia. Ha (2001, 2003) evaluated the service quality of nine container ports in Northeast Asia in 2001, and selected information availability, port location, port transit time, facility availability, port management, and port-related activities in 2003. Seven factors, such as port rate and customer convenience, are analyzed. From the analysis results, these factors have a direct or indirect relationship with port service quality and affect port competitiveness. Jose (2001) pointed out that port efficiency is also an important factor affecting port competitiveness and uses the DEA model to analyze the efficiency of four ports in Australia and twelve international container ports. Wang et al. (2006) constructed 19 first-level indicators such as port operation conditions, port service level, port environment, port container throughput and growth rate, port equipment conditions, and modern management level for the competitiveness evaluation of container ports. The evaluation system of the secondary indicators, and the entropy weight fuzzy comprehensive evaluation method under the guidance of port research and related enterprise research and interviews, proved the rationality of the index system. The study, by Theo Notteboom and Wei Yim Yap (2012), shows that the configuration of liner services has direct and indirect impact on port competition about containers. Yu (2013) used the analytic hierarchy process to calculate the importance of port development factors and found the operation and management of ports in general ports and the efficiency of modern logistics services are the primary factors. Wei and Hu (2017) selected the entropy-TOPSIS and DEA algorithms to conduct an in-depth empirical analysis of the competitiveness of major coastal ports and the efficiency of port operations. They believe that the management level of the port affects the port competitiveness, and the

management level includes the service level, informatization level, port freedom and management model innovation. Wang (2018) using the dynamic efficiency-Manmquist productivity index to evaluate the changes in the sustainable competitiveness of China's seven container port enterprises in a certain period of time, based on the theory of sustainable port competitiveness from the dynamic point of view, it is considered that the change in the productivity of the port is more related to the change in the throughput of the port than the change in the size of the port facility.

It can be seen that the port operating conditions, port management, port scheduling, port services and operation efficiency, which reflect the port's operation efficiency, all have an important impact on port competitiveness. There are also differences in port operation efficiency between different countries, regions or ports. Based on the above discussion, this study proposes the following hypothesis:

Hypothesis 3: Port operation efficiency is positively correlated to port competitiveness in Beibu Gulf port.

2.4 Institutional theory

2.4.1 Overview of institutional theory

"Institutions" are very useful for people to understand the differences in the development process of organizations in different time and space, and also provide a crucial source of concepts and ideas for theoretical comparison and analysis. Institutional theory has always been developed in areas of economics, political science, and sociology (Scott, 2008; Guo, 2009). In the early institutional theory, institutional researchers in economics challenged traditional economics; Institutional researchers in political science pay more attention to normative analysis, adding vitality to the construction and functional research of political institutions; The study of sociology has produced a large number of institutionalists, who emphasizing the functional role of institutions in the process of social construction, the interaction of institutions and people (Guo, 2009).

2.4.2 Institutional theory and institutional environment

Before the 1970s, researchers often only noticed the role and influence of the technological environment on the organization, that is, take the organization as an input-output production system by the mid-1970s, researchers began to recognize the broader social and cultural factors that the institutional environment had on the organization. Therefore, combined with the development of the above-mentioned institutional theory, it can be concluded that the institutional theory is earlier than the institutional environment.

With the development of new institutionalism, researchers have deepened their understanding of institutional theory. They agree that institutions are extremely important because they determine the feasibility and profitability of an economic activity by affecting production and transaction costs. After the 1970s, researchers gradually realized the importance of the institutional environment. They proposed that the institutional environment is one of the important components of the business environment and has an important impact on the strategic choice and performance of the enterprise. Therefore, the influence of institutional environment on corporate strategy and performance has become one of the core research issues of institutional theory (Peng, Sun, Pinkham & Chen, 2009). Therefore, the institutional environment is one of the components of institutional theory in terms of research scope and content.

2.4.3 Concept of institutional environment

The most influential research on the definition of institutional environment is North and Scott. For example, the system is a social game rule, which is a kind of artificially designed and shaped interaction of people's interactions, and further divides the system into two aspects: formal and informal. (North, 1990). The formal system includes the rules and contracts designed by human beings in politics, law, society, and economy and the informal system includes customs and culture. In terms of the composition of formal and informal institutions, even in the most developed countries, formal institutions account for only a small part of all institutional rules (North, 1990). Therefore, the measurement of the institutional environment should pay special attention to measure the informal institutional environment.

Scott (1995) points out that institutions consist of structures and activities of cognition, regulation, and regulation that provide stability and meaning for social behavior. Specifically, the cognitive dimension is derived from the common beliefs of members of society, and the legitimacy is based on cultural orthodoxy. The normative dimension defines the objectives and the appropriate means to achieve them, and the legitimacy is based on social beliefs and customs. The regulatory dimension is based on the development of monitoring and enforcement rules, which is a tool logic, and legal sanctions are a source of legitimacy.

In recent years, with the continuous advancement of institutional research, researchers have made a more detailed distinction between institutional dimensions based on North and Scott. For example, Ghemawat (2001) divides the formal system into two dimensions: management and economics. Berry (2010) divides the formal system into dimensions such as economics, finance, politics, management, population, knowledge, and global connectivity.

2.4.4 Measurement of institutional environment

After clarifying the concept of institutional environment, how to measure the institutional environment has become another issue in academia. From the existing research, it is mainly based on the overall institutional environment, political environment, legal environment and other aspects of specific measurements. Regarding the measurement of the overall institutional environment, there are mainly the following methods: (1) Marketization index and sub-index. Because the market-oriented region means that the overall institutional environment is good, most of the existing research uses the marketization index to measure the institutional environment of each region. For example, the relative indice of market processes in various regions of China developed by Fan and Wang (Fan & Wang, 2001). Gao (2010) uses the marketization sub-indexes such as "the development of market intermediaries and the development level of product markets" to measure the institutional environment of each region. (2) GDP/government budget. In the market economy, resources are more allocated by the market. Therefore, some studies use the role of the market in the allocation of resources to measure the institutional environment (Wang, 2011). (3) Other methods. Some studies have measured the entrepreneurial institutional environment in each region by survey

data, focusing on the degree of support of the institutional environment for entrepreneurship and innovation activities (Jiang, 2010).

Regarding the measurement of political environment, the existing research mainly measures from the aspect of government intervention. The main methods are: (1) Marketization index, (2) Time measurement, (3) Local government fiscal pressure. (1) Marketization index and "Government and Market Relationship Index" are used to measure the degree of government intervention (Liu et al., 2007). (2) Time measurement: The time spent dealing with government agencies to measure government intervention, the longer the time of dealing, the higher the level of government intervention (Yu & Pan, 2008). (3) Measured by local government fiscal pressure. The greater the financial pressure of local governments, the more likely it is to strengthen intervention. The specific measurement indicators of this method include local fiscal decentralization index (Xu & Qiao, 2012), fiscal expenditure/GDP and fiscal deficit/GDP (Cheng et al., 2008).

Regarding the measurement of legal environment, the principles and methods are basically similar to the above-mentioned environmental measurements. One is the marketization index. In the study, the "legal system environmental index, the proportion of lawyers, the property rights protection index" is commonly used for measurement. The second is measured by the input expenditure method. The investment is often measured by public inspection method expenditure/GDP, public inspection law expenditure/financial expenditure and other indicators. Expenditure is often measured by the rate of economic case settlement (Yu & Pan, 2008; Jin et al., 2008).

2.4.5 Existing research on institutional theory in port economy

The system is a series of ethical norms of rules, law-abiding procedures and behaviors. The generalized system includes formal and informal rules. These rules are intended to constrain individual behaviors that pursue subject welfare or utility maximization. Human behavior also affects the efficiency of resource allocation. The system has even become the most important factor affecting economic growth and economic development of all countries (North, 1990). The system is equally important for the development of the port economy, but

there are relatively few studies on the theory of the development of port economy. According to the formal system and the informal system, the relevant literature is sorted out. The research on institutional theory and port economy mainly focuses on law and politics, culture and other aspects.

The port is considered to be the “lifeline economic sector” of the country and is one of the important guarantees for the country's economic security (Yang, 2011). In the context of economic globalization, the port development sector faces competition from international transportation companies and the threat of national economic interests and comprehensive transportation autonomy brought about by foreign direct investment construction. Therefore, it is necessary to strengthen legislation to ensure the economic security of port countries. The port economy is an open economy. Therefore, in order to make the port economy smooth and healthy, it is necessary to strengthen the establishment and improvement of foreign-related laws and regulations. Based on understanding and mastering the basic principles and relevant rules of the WTO, we will establish and improve a foreign-related legal system that is in line with WTO rules and is suitable for China's port economic development as soon as possible. (Guo & Liu, 2002).

Research on the political environment and the development of port economy. Zhou (2003) found that under different market structures, the port industry effect caused by the port's business strategy and the government's regulatory interventions is different, and it is necessary to implement government intervention for monopolistic ports by means of limiting the port charges; For oligopolistic ports, the government uses the strengths of several ports to adopt taxation, subsidies, and encourage competition to develop the port economy.With the passage of time, reducing government intervention and gradual marketization is the general trend of port management (Tu, 2006). China's port development should be combined with the actual situation, play an active role of the government in port economic activities, build a cluster port city government to jointly create a public environment, industry coordination and self-discipline, capable and efficient port industry management system, establish and improve the related dynamic and benign mechanism of consultation, coordination and cooperation. Forms a new situation of a unified, efficient and harmonious development of port groups

which in turn provides a strong guarantee for the port economy and regional economic development.

There are some conclusions about the study of culture and port economic development. Through research, Zhang and Zhou (2007) found that the developments of port culture and port economy are complementary and mutually reinforcing. Both the port and the hinterland government departments have the responsibility to strengthen the process of cultural value, the transformation of government functions and the process of institutional innovation and continue to "lock" the path of economic integration between the port and the hinterland in an efficient state (Wang, 2009). No matter how efficient the port is, how strong the economic strength is, the sustainable development of society, the environment and even the humanity is the foundation of long-term development (Dong & Zhen, 2008).

2.4.6 Influence of institutional environment on port competitiveness and research hypothesis

Scott (1995, 2001) pointed out that institutional theory provides the most promising and creative lens for us to observe organizations in contemporary society and discusses the impact of competition mechanisms in the institutionalization of social systems on organizations. Impacts on the outside of the organization include social systems and organizational groups. Winkelmans (2001) analyzed the competitiveness of European ports from the perspective of port law and port policy. The study found that port competitiveness is affected by shipper demand, transportation production conditions, rival competition, port policy, and economic environment. In addition, the management system of the port, its own management level, and the use of new technologies are the most fundamental and key means for the port authorities to improve their competitiveness (Yuan, 2001). The integrated logistics capabilities of the logistics system at the port and the port's ability to control the overall logistics system have become the key to port location development and competition (Dong, 2005). Rugman and Verbeke (2004) have shown that institutional environmental impact is an important determinant of port competitiveness. Liang and Lu (2010) used Politics, Economy, Society, Technology (PEST) analysis method to analyze the external environment of port development

in Shandong Province: policy environment, economic environment, social environment and technical environment. A strategy for improving the environmental development of ports is proposed. Xie and Chen (2012) developed the coastal ports of Guangdong Province from three aspects: the needs of national regional strategy, the international and regional industrial transfer, the continuous improvement of people's living consumption demand, and the differences in the socio-economic development of port cities in the region. The environment was analyzed and the development strategy of coastal ports in Guangdong Province was proposed accordingly. Hao et al. (2015) analyzed the development environment of China's coastal ports from the perspectives of international economic and trade environment and domestic economic and trade environment, and proposed how China's coastal ports should be further developed to meet the needs of economic development. On the basis of resource theory and institutional theory, Cho et al. (2015) divide port resources into tangible and intangible resources. As a determinant of the competitiveness of container ports, they constructed structural equation model between the six variables of shipping connectivity, operation efficiency and institutional influence, competitiveness, throughput, infrastructure quality, and liner using the data of transnational ports to analyze the mechanism of various factors on the competitiveness of container ports, It also verified that the system has strengthened the impact on port operation efficiency and port competitiveness, and weakened the relationship between port facility quality, port cargo volume and liner contact capability and port competitiveness.

Under the conditions of China's “Belt and Road” development strategy, the Beibu Gulf Port has become the starting point of China's southward sea channel. Does the institutional environment contribute to the competitiveness of the Beibu Gulf Port? In order to verify the institutional environment and the adjustment effect of the relationship between resource conditions and competitiveness, the following hypotheses are made:

Hypothesis 4: The institutional environment moderates the relationship between port facilities conditions and port competitiveness. Specifically, when the institutional environment is favourable, the positive relationship between port facilities conditions and port competitiveness will be stronger.

Hypothesis 5: The institutional environment moderates the relationship between port connectivity conditions and port competitiveness. Specifically, when the institutional environment is favourable, the positive relationship between port connectivity conditions and port competitiveness will be stronger.

Hypothesis 6: The institutional environment moderates the relationship between port operation efficiency and port competitiveness. Specifically, when the institutional environment is favourable, the positive relationship between port operation efficiency and port competitiveness will be stronger.

2.5 Port throughput

2.5.1 Concept of port throughput

Port handling capacity is also known as port capacity or port throughput. It is the most important indicator to measure the size of the port. Reflected in certain technical equipment and labor organization conditions, the number of cargoes loaded and unloaded by the port for a certain period of time is usually expressed in tons.

In addition, the academic community has defined the concept of port throughput from different perspectives. For example, port throughput refers to the number of goods that are loaded and unloaded through the waterway into and out of the port area (Kuang, 2009; Sun et al., 2012). At present, the indicators that reflect the scale of port logistics are: port cargo throughput, port container throughput, port traffic and port routes. Port cargo throughput is the most basic indicator for measuring the scale of port logistics. It reflects the production scale of the port and the internal productivity distribution of the port, reflecting the status of the port in the national economy and social and economic development. According to the total throughput of each port, coastal ports can be divided into three categories – large ports, medium-sized ports and small ports (Wang et al., 2018).

2.5.2 Port throughput and port competitiveness

Under the background of economic globalization, the throughput of global coastal ports has increased rapidly, and the throughput of China's coastal ports has also achieved leap-forward development. However, in recent years, the scope of competition between ports has been expanding and competition has become increasingly fierce. In the study of port throughput and port competitiveness, Chinese scholars have conducted in-depth research and believe that cargo throughput is the most basic indicator for evaluating port logistics. Huang et al. (2017) used the indicators of cargo throughput and container throughput to evaluate the competitiveness of green ports. The results showed that the greater the cargo throughput, the stronger the port's ability to carry goods, and the greater the port's dominance over the market. Zhou and Di (2011) also regard port competitiveness as one of the three important factors for port competitiveness when analyzing the competitiveness of Qingdao Port in the Bohai Rim region. Kuang and Chen (2007) constructed the port comprehensive competitiveness index system, port throughput was also considered as one of the four important evaluation factors. It is considered that the port's throughput capacity is a reflection of the port's comprehensive strength and one of the important performances of the port's competitiveness. Sun et al. (2013) selected an evaluation system including international standard container throughput, cargo throughput and passenger throughput in the comprehensive evaluation of port competitiveness in China's coastal areas, and port throughput as an important performance of competitive performance. From the research of Kuang and Chen (2007), Zhou and Di (2011), Sun, Wang and Guo (2013), Huang, Mo and Cheng (2017) and Wang et al (2018), we can easily find that there is a positive correlation between competitiveness and port throughput: the improvement of port competitiveness will help improve port throughput. And make the following hypotheses:

Hypothesis 7: Port competitiveness and port throughput are positively correlated.

Hypothesis 8: The institutional environment moderates the relationship between port competitiveness and port throughput. Specifically, when the institutional environment is favourable, the positive relationship between port competitiveness and port throughput will be stronger.

Hypothesis 9: Port competitiveness is a mediator of port resources and port throughput.

In summary, the overall research design of this study are as follows: Based on the measurement of port competitiveness, the relationship between resource theory, port resources and port competitiveness and its hypothesis, this study first explores the impact of port resources such as tangible and intangible resources on port competitiveness and its role; Secondly, based on the previous relationship between institutional theory, institutional environment and port competitiveness and its hypothesis, we further analyze the impact and influence of institutional environment as a moderator on port competitiveness and port throughput; Finally, further analyzed the port competitiveness which as a mediator of port resources and port throughput, and the impact of port throughput and its role on port competitiveness. The research model is shown in Figure 2-1.

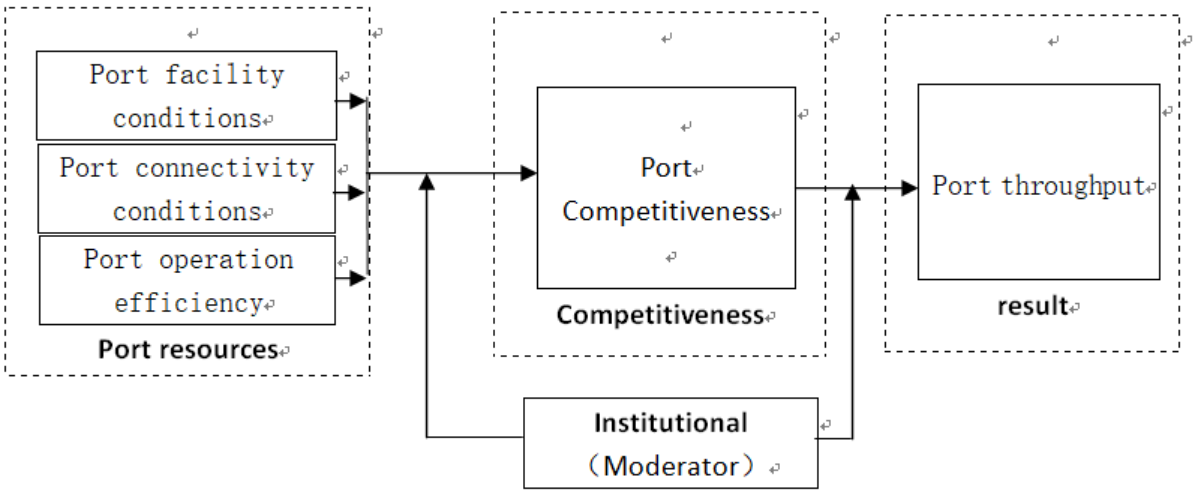

Figure 2-1 Theoretical model of port competitiveness by resources-based and institutional perspectives

Chapter 3：Beibu Gulf Port of Guangxi

3.1 Geographical location

The Guangxi Beibu Gulf port has a 1629km coast line, and consists of Qinzhou port, Beihai port and Fangcheng port, located on the southern tip of the Guangxi Zhuang Autonomous Region. Beibu Gulf port located is on the north shore of Beibu Gulf, on the east of Washing Rice Estuary and west to Beilun River Estuary. The Beibu Gulf port has a wide area of water, large tidal volume, hidden terrain and low depth. In addition, with low sedimentation conditions, the harbor basin has great development potential and superior geographical location. Therefore, the Beibu Gulf is not only a deep-water port in the southwest coastal area, but also the most convenient sea-out channel in the southwest China and an important port for maritime trade among China and ASEAN countries. The geographical location of Guangxi Beibu Gulf Port is shown in Figure 3-1.

Figure 3-1 Geographical location map of Guangxi Beibu Gulf port

The Qinzhou port of Beibu Gulf which is located in Qinzhou city and it faces southeast Asia and backs to the southwest China. It belongs to the Qinzhou Bay in the central part of

the South China Sea Beibu Gulf, as transportation hub of Guangxi, and has a convenient land and sea transportation system. It is an important hub of port and has a comprehensive transportation system in Guangxi. It is the core carrier for the construction of the regional international shipping center of the Beibu Gulf. It provides a vital support for the layout of the port industry and development of the Beibu Gulf Economic Zone. It is an important open door to the countries in the southwest China. Qinzhou port is an important part of Guangxi's new gateway and new hub for the 21st-Century Maritime Silk Road. Its throughput has been growing rapidly these years. The throughput and container throughput of Qinzhou port had reached 6.954 million tons and 1.37 million TEU in 2016.

As one of the main coastal ports in China, Fangcheng Port is not only an important maritime trade port between China and ASEAN countries, but also an important strategic support for the country to implement Western Development Strategy and expand its opening to the outside world. At the same time, it is also an important support for the development and opening up of the Beibu Gulf Economic Zone and the construction of China ASEAN Free Trade Area. The Beibu Gulf Fangcheng port plays an important role in the economic and social development of Fang Chenggang city and the development of port industry. Fangcheng Port has a superior geographical position in the central of southwest China, Guangdong, Hong Kong, Macao and South East Asia. Fangcheng port throughput and container throughput reached 1.0688 million tons and 0.27 million TEU in 2016, a slight drop as compared to 2015.

The Beihai port in Beibu Gulf not only has the advantages of wide water area, large tidal volume and small water depth, but also has better natural conditions such as the terrain concealment and the little silt up in the harbor channel. With a coastline of 528.16km, Beihai has a deep-water harbor in the southwest coastal area of China and has great potential for development. Beihai Port has become an important support for the optimization of the Beihai industrial structure and the surrounding economic development. As the hub of Guangxi's important coastal ports and integrated transport system, Beihai port with a 2.75 million tons throughput in 2016, has entered a stage of steady and rapid growth. Beihai port is not only the most convenient access to the sea in the southwest China, but also an important support for the development and opening up of the Beibu Gulf Economic Zone in Guangxi.

3.2 Development course

Before the 1990s, the development of coastal ports in Guangxi was slow and the overall development level was relatively backward. Fangcheng port was constructed since 1968 as the main purpose of combat readiness. In 1970, the port authority was established. As early as in the 1870s (1876), the Beihai port was opened as a port of Commerce. However, the port of Beihai was still in a very slow development state before liberation. Beihai city began to construct its port in 1953 and the port authority was formally established in 1966. Although the government has listed Beihai as a coastal open city in 1984, there were only 13 berths produced in 1990, and only 2 berths were above ten thousand tons level. As a military port, early Qinzhou Port has not been able to develop on a large scale, mainly due to regional ownership issues and the need for coastal defense construction. Shajing, Longmen and Mau Ling port were the earliest port of Qinzhou port, but all the terminal berth level is less than 500 tons and the annual capacity is only 40~50 tons. Since 1973, the State Council approved the expansion plan of international trade terminals and the construction of 10,000 tons of deep water berths. In 1986, seven 1 to 25-thousand-ton deep water berths were put into operation, and the first 30-thousand-ton berth was put into operation in 1992.

In the 1990s of the last century, the Central Committee proposed the strategy of "playing the role of Guangxi as the channel of the southwestern region", which accelerated the construction of Guangxi coastal ports, so the Beihai port and Fangcheng port took the lead in building deep and intermediate berths. Qinzhou port was officially opened in January 1994. In the 1990s, the pace of construction of coastal ports in the region has accelerated, with a total number of 89 new berths and 13 million 620 thousand new capacity of the Guangxi coast were built, including 10 deep-water berths. The entire coastal port has formed a general structure with the public ports of Beihai Port, Fangcheng Port and Qinzhou Port as the main body, commercial and enterprise-specific terminals as supplement. With the establishment of a certain scale of port infrastructure, the scale of the port, the degree of intensive and the scope of service have made a considerable promotion. Thus, it has initially formed an important outlet for the connection among the southwest, the domestic and foreign markets,

which has become an important support for the economic development of Guangxi.

Guangxi coastal ports have shown a rapid development trend since this century. Port construction, deep-water wharf and waterway construction have entered a new period of development and have achieved remarkable achievements. Since the Beibu Gulf Economic Zone was established in 2007, the Beibu Gulf Port has experienced rapid development opportunities. For example, the port infrastructure construction has been continuously strengthened, the professional level of the terminal has been continuously improved, and the port throughput has been significantly improved, which has also led to the development of large-scale productivity. A number of new port areas such as Qisha port, Dalan Ping port, and Tieshan port have been launched successively, and port industry and port logistics functions have been continuously expanded. In 2009, in particular, the Ministry of transport merged Fangcheng port, Qinzhou Port and Beihai port into one, to form Guangxi Beibu Gulf Port. Port infrastructure construction has ushered in new development opportunities, not only speeding up development, but also greatly improving service levels and capabilities.

3.3 Strategic positioning and function

In 2008, the Ministry of Communications of Guangxi Zhuang Autonomous Region, the Beibu Gulf Economic Zone of Guangxi Zhuang Autonomous Region and the ASEAN Open Cooperation Office together completed *The Overall Planning of Guangxi Beibu Gulf Port.* The role and objectives of the Guangxi Beibu Gulf Port have been clarified. The first is an important corridor and hub connecting the ASEAN countries; The second is the status of the regional international shipping center; the third is to create a new strategic fulcrum for the open and development of southwest and central China; the fourth is to provide core resources for the organic formation of important portals; and the last one is an important platform for the construction of China ASEAN Free Trade Area, driving the hinterland economic and social society development and realizing a well-off society.

The general program also plans the strategic position of Guangxi Beibu Gulf Port, which is in line with the needs of the country's opening up strategy and has become an important

gateway for the opening up of the southwest, central and southern China. It is an important support for regional economy and industrial development, and a key link in the construction of comprehensive transport system. It is also an important carrier of regional shipping center and logistics center. It will strongly support the construction of Guangxi's new strategic fulcrum and serve the long-term opening and development of central, south and southwest China.

The main functions of Guangxi Beibu Gulf port are as follows. First, provide transportation needs for bulk goods and containers such as coal, oil and ore for the development of port hinterland economy and port industry. Second, promote the economic and social development of the hinterland so as to meet the needs of leisure tourism passenger transport. Third, the port has loading and unloading functions, modern logistics, multimodal transport and shipping services, as well as port and passenger travel. In addition, it can be used as a regional international cruise port for loading, unloading, warehousing and modern logistics, multimodal transport and bonded, passenger travel and shipping and other services. At the same time, Guangxi Beibu Gulf Port will build a bulk cargo and auxiliary container transportation system centered in Fangcheng port, build a container and petrochemical transportation system centered in Qinzhou Port, and build international cruise passenger transportation, second trade and cleaning materials transportation centered in Beihai port.

3.4 Port throughput

In recent years, with the rapid development of heavy chemical industry in the Beibu Gulf Economic Zone, the growth rate of port throughput has been greatly increased, and the functions of port industry and port logistics have been expanded continuously. The cargo throughput of Guangxi Beibu Gulf Port in 2016 is 203.92 million tons, an average increase of 12.3% more than in 2008. Foreign trade cargo throughput accounts for about 60% of the total cargo throughput. This proportion is basically stable in recent years and the specific number is 120.94 million tons. According to the statistics, Fangcheng port has the maximum throughput, and Qinzhou port has the fastest growth rate and undertakes the main container transportation mission of Guangxi Beibu Gulf Port. In 2016, the throughput of Fangcheng port is 106.88

million tons, Qinzhou port is 69.54 million tons and Beihai port is 27.5 million tons, increased by -0.4%, 6.8%, 11.4% separately, accounting for 52.4%, 34.1% and 13.5% separately of the total throughput of Beibu Gulf port. Container transport has been accelerated in the development of Qinzhou port, and Qinzhou port container volume accounts for 44.5% in 2010 of the Beibu Gulf port, has been increased to 66.5% in 2015 and 76.5% in 2016.

From the perspective of throughput composition, coal, metal ore and oil are the main goods, but the proportion has declined. In 2010, the total throughput of the three major cargo categories was 78.76 million tons, which accounted for 66.1% of the total throughput. In 2016, the total throughput of coal, metal ore and three major goods was 120.21 million tons, accounting for 58.7% of the total volume of cargo, down for 7.4% than 2010. The main reason for this reduction is the decline in throughput of coal and metal ores. In 2016, the total throughput of the three major cargo stores accounted for 54.8% of the total throughput, which was 3.9 percentage points lower than that of 2015, mainly due to the decline in the share of coal.

The average annual growth rate in 11th Five-Year and 12th Five-Year reached 30.1% and 20.5% respectively, which were higher than those of the coastal ports in the same period. In 2016, the cargo throughput between Qinzhou port and ASEAN countries main ports was about 9.8 million tons, which accounted for 30% of Qinzhou port's foreign trade cargo throughput. Among them, the container throughput of Qinzhou port with main ports of ASEAN countries is about 15 thousand TEUs, accounting for 5% of Qinzhou port's total foreign trade container throughput. The cargo throughput of the Beihai port with the main ports of the ASEAN countries is about 4.5 million tons, and it accounts for about 50% of the cargo throughput of Beihai port.

3.5 Port facilities conditions

By the end of 2016, the main index of Guangxi's Beibu Gulf Port are as follows: the productive berths increased to 263, among which there are 94 berths for ten-thousand-ton ships above; the total terminal length reached 37km, which has achieved the level that annual

comprehensive pass capacity was 253.83 million tons and 4.79 million passengers. It is understood that the largest tonnage berth in Beibu Gulf port at present is 200 thousand tons, 300 thousand tons of ore terminals, 200 thousand tons of container terminals and 300 thousand tons of crude oil terminals. However, the overall infrastructure such as collection and distribution which are not consistent with the status of regional bulk cargo and container hub ports still need to be improved. Port adaptability, which is the ratio between port throughput and throughput, is about 1.2. It can adapt to the current freight demand, but there is still a big gap compared with the eastern coastal areas in the aspects of intensification, grade and the level of specialization and modernization.

3.5.1 Shoreline length of wharf production

Wharf production shoreline along the port is a specialized berth that can be arranged in thousands of tons ships and above. It is the core resource of the port. The planning and design production shoreline of Beibu Gulf port is about 219.372km, of which the Deepwater Port Shoreline accounts for 74.65% of the total planning line, and the length of the port line is 163.772km. The port lines in use now is 38.939 km, of which the deep-water port shoreline is 28.266km; Among them, the Fangcheng port coastline is about 95.987km, and 14.666km is in use now; the Qinzhou port coastline is about 65.487km, and 15.864km is in use now; the port coastline of Beihai port is about 57.907km, and 8.409km is in use now. The planned 27 kilometers of Qisha East port and the 20KM of Tieshan West port are used as the frontier reserve port coastline. The northern port has not used a coastline of about 253 kilometers, but the main port areas providing public transport for the port scale development shoreline is about 89 kilometers, accounting for 35% of the unused shoreline in the Beibu Gulf.

3.5.2 Port berth

By December 2016, a total of 263 productive berths were completed in Beibu Gulf Port, among which there are 94 berths for ten-thousand-ton ships above, 25383 (ten thousand tons) through capacity, and 4.79 million-person times in year, and the throughput of 203.92 million tons in 2016.

The Jingu port area and the Da Lanping port area are the main locations of the existing berths in Qinzhou port. There are 79 productive berths and 32 berths for ten-thousand-ton ships above. The total length of the quay is 13,464m, and the annual design and passing capacity of the goods is 100.8 million 800 tons (including the container 2.33 million standard box, the car 422 thousand standard) and the passenger 450 thousand.

In addition to the Yuwan port area and Qisha port area of Fangcheng port, there are many port points, such as Zhushan port point and Bailong port point; Jingdao port point, Maoling port point and Tanji port point among others, totaling 7 port points. At present, about 119 productive berths have been built, 35 of them are for ten-thousand-ton ships above, the quay coastline is up to 15200m, and the annual comprehensive passing capacity reached 84.29 million tons (of which the container is 1.85 million standard cases) and can transport 100 thousand passengers.

Beihai port is composed of port area of Shibu Ling, the west and east of Tieshan, and the Weizhou island port area which include the port of Haijiao and Qiaogang. At present, there are 58 productive berths in Beihai port, 12 of them are for ten-thousand-ton ships above, the total quay length is 6679m, and the capacity of the goods is 39.48 million tons (including 50 thousand standard containers for containers, 350 thousand cars for cars) and 4.36 million passengers per year.

The berth status and throughput of Guangxi Beibu Gulf port in 2016 are shown in table 3-1.

Table 3-1 Status and throughput of berths in Guangxi Beibu Gulf port

Port	Fangchenggang	Qinzhou	Beihai	Total
Mooring number (a)	120	81	62	263
Berths above ten thousand tons	36	43	15	94
Maximum berth grade	20	10	15	20
Annual capacity (ten thousand tons)	9105	11114	5164	25383
Passing through the year (ten thousand person-time)	10	33	436	479
Throughput in 2016	10688	6954	2750	20392

Source: China Port Yearbook (2017), Guangxi Statistical Yearbook (2017) and by Guangxi Beibu Gulf Port Group(2017).

3.5.3 Port channel passing capacity

At present, there is a total of 9 channels in Beibu Gulf port. The maximum navigable capacity of Beibu Gulf port is 1.01 million tons, and the length is 179.1km. Fangcheng port is an entry channel consisting of two outer channels, the West channel and the East channel. The maximum tonnage of navigation is 200 thousand tons. The entrance channel of Qinzhou port was made up of East and West, and the 300-thousand-ton-grade Qinzhou port channel was completed in June 2017, and it can be used to berth 300 thousand-ton ships. The maximum navigable tonnage of Beihai port is 100 thousand tons. In addition, the two-phase extension of Tieshan port dredging and the three-phase project of Tieshan port waterway have been started constructed.

In 2016, Guangxi's Beibu Gulf port's existing entry channel is shown in table 3-2.

Table 3-2 List of Guangxi Beibu Gulf port entry channel in 2016

Port	Channel name	Navigable tonnage (ten thousand tons)	length(KM)
Fangchenggang	Sanya Channel	20	17.3
	West Bay Channel	3-10	7.6
	East Bay Channel	5-10	8.1
Qinzhou	West Channel	1	24.4
	East Channel	3-10	36.0
	300 thousand ton grade Channel	30	34.3
	Jingu River Channel	0.5-5	6.2
Beihai	Shi Buling Port Channel	5	16.4
	Tieshan Port Channel	3.5-10	28.8
Total	9	101(Max)	179.1

Source: Guangxi Beibu Gulf Port Group(2017).

3.5.4 Anchorage

There are 17 anchorages in Guangxi Beibu Gulf port. The total area of the existing anchorage is 22.086 km^2, and 28 anchorages are planned. Among them, there are 8 anchorages in Qinzhou port, including 4 anchorages in the port and 4 anchorages outside the port. In addition, there are 5 anchorages approved by the State Council and 3 temporary anchorages. There are 4 anchorages outside Qinzhou Bay, of which 0# anchorage is 10000-ton anchorage, 1# anchorage is 1000-ton to 2 000-ton anchorage, and 2# and 3# anchorage is 50-thousand-ton anchorage. Planning for 12 anchorages outside the port, and leaving 3 anchorages outside the port, the area is 580.9km^2, which meets the needs of pilotage, pending and quarantine.

Fangcheng port now has 0# anchorage, 1# anchorage, 2 to 1 anchorage and 2 to 2 anchorages. The radius of 0# anchorage is 1km, which is the pilot and quarantine anchorage for the harbor area of Fangcheng port, and the anchorage of the 1# anchorage is a large ship to be moored and the anchorage, and there are 10 anchorages, and the 2 - 1# anchorage is a 5~7 - ten - thousand - ton ship waiting anchorage. The 2 - 2# anchorage is for 5-ton to 10-ton ships waiting. To meet the requirements of pilotage, pending and Quarantine of vessels above 1~30 tons, Fangcheng port plans 8 port anchorages with an area of 509.1km^2.

There are 1 to 2 million ton anchorages and 3~5 ton anchorages in 1 of the Shi Puling port. The 1~2 000 ton anchorage area is 6.5km^2, and the water is over 11m of depth. The outer anchorage area of the 3~5 ton port is 5.7km^2 and the water is about 16m depth. Tieshan port area has 1~5 ton anchorage, LNG special anchorage and 100 thousand ton anchorage each of 1. Outside Tieshan Bay, 7 West Port Areas and Donggang District of Tieshan port are planned to be anchored, and 1 anchorages in Bay are planned in the bay. The total area of anchorage is 263.45km^2 to meet the needs of all kinds of ships moored and quarantined.

3.5.5 Traffic infrastructure in the case of railway and airport

The railway lines of Beibu Gulf port area include the south line and the QinGang line, the Qinbei line and the Rikin line and the jade iron line, which are connected to the port wharf and connected with the Yunnan, Guizhou, Hunan and other regions of the Midwest. In recent

years, the expressway network has covered the entire Beibu Gulf port, and the highway network in the area has been achieved in all directions. The expressway network includes Qinzhou to Fang Chenggang, Beihai, Yamaguchi, Guangdong, Nanning, Chongzuo, Fangcheng to Dongxing, Liujing to Qinzhou. In addition, a two-grade highway network has been built. Thanks to the highway network, the port areas could access to Guangxi, southwest China and Vietnam through at least two kinds of port roads. Besides, the Guangxi Binhai Highway, which is under construction now, has been partially built into traffic, and a number of domestic and foreign routes have been opened in each port area. The sea can directly reach China's main ports along Hainan, Guangdong, Hong Kong and Macao and other regions of the world; Beihai Airport has been built in the area with a flight area of 4C. At present, several domestic routes have been opened in the domestic sub trunk airport.

3.6 Port connetivity conditions

3.6.1 Port logistics park development

Relying on the development of the Beibu Gulf port, the development of trade and logistics in the Beibu Gulf Economic Zone is beginning to appear in an embryonic form. With the port as the core node, the logistics network and traffic system around the port industry, the transport of materials in the southwest and the international trade and home trade are being formed. At present, the three cities in Beibu Gulf harbor have compiled the plan of developing the logistics park respectively. The general development pattern and function orientation of the logistics park are clearly defined, as shown in table 3-3.

Table 3-3 Distribution of main logistics parks in Beibu Gulf Port

NO.	Entry name	Planning area (ten thousand square meters)	Major function
1	Fangchenggang comprehensive logistics park	1400	International integrated logistics
2	Bus Logistics Park	1000	Rear logistics of port and steel base

3	Qinzhou port comprehensive logistics processing area	1200	Logistics processing
4	Qinzhou bonded port area	600	Regional international shipping hub, logistics center and export processing base. It has the functions of port operation, international transfer, international distribution, international procurement, international re export trade, bonded processing, bonded logistics and commodity display.
5	Qinzhou port petrochemical logistics trading center	385.2	Petrochemical logistics transaction
6	Beihai Shi Buling Logistics Park	58.9	To provide warehousing, distribution and distribution services for port export processing zones.
7	Beihai Tieshan port logistics park	764.2	Mainly for Tieshan port logistics storage, transfer and collection function, form port and public transport and water transport logistics park.
8	Beihai Tieshan port area logistics center	205.8	For industrial service warehousing, industrial distribution and commercial, wholesale, commodity display, logistics information services and other functions, and combined with the Beihai export processing zone Tieshan port area (or Beihai export processing zone B area) start, the development of ports, circulation, bonded warehousing, customs export supervision and management functions.
9	Nanning bonded logistics center	53.55	Bonded logistics
10	China ASEAN International Logistics Base (Nanning)	1909	It integrates export processing, logistics and distribution, bonded logistics, commerce, warehousing, product display and other functions.
11	Fangchenggang Chonglun comprehensive logistics park	1200	Trading and integrated logistics services such as building materials, machinery and equipment.

12	Dongxing Port International Logistics Center	50	International, border trade logistics, commodity trading and Conference
13	Nanning Liujing Logistics Park	80	Radiating the Yangtze River Delta region, Guizhou, Hunan and Northern Guangxi and Beibu Gulf regional logistics nodes to develop multimodal transport of public water

Source: Municipal Government websites of the Guangxi autonomous region, Qinzhou City, Beihai City and Fangchenggang City.

At present, Nanning bonded logistics center (B), Qinzhou bonded port area, China-ASEAN Pingxiang border Comprehensive Bonded Zone, Beihai export processing zone, and other large logistics parks have been built up, and the distribution of the Beibu Gulf Port logistics parks and special regulatory areas are shown in Figure 3-2.

Figure 3-2 Distribution of logistics parks and special regulatory areas in Beibu Gulf port

3.6.2 Port collection and distribution system

In terms of port collection and distribution system, the Guangxi Beibu Gulf port has formed a three-dimensional collection and distribution system which is mainly composed of highway, railway, water transportation and pipelines. In 2016, the proportion of traffic volume in Beibu Gulf port highway, railway, water transport and others (mainly pipe and belt conveyor) was 61%, 20%, 8% and 11% respectively. From the whole port point of view, the way of road collection and transportation occupies the dominant position, especially since

2010, driven by the rapid development of the port industry, the increase of freight volume is mostly by the roads, pipes and belt machines. Among the three ports of Beibu Gulf port, the railway and water transfer volume are mainly concentrated in Fangcheng port. It mainly serves the bulk materials such as coal and ore in the south-west hinterland and water and, Fangchenggang railway accounted for 31% of the total traffic volume, ranking three in the port area; the port and port area of Qinzhou port accounted for 25% of the total volume of pipeline and belt conveyors, the highest among the three ports, mainly serving petrochemical, grain and oil and power plant enterprises of the port.

3.6.3 Port logistics company

Modern port logistics enterprises not only include services such as transport, storage and distribution, packing and processing, and cargo handling, but also have integrated logistics services such as multimodal transport and information processing, the purpose of its service is to select goods that meet the requirements of operation according to the port's own conditions and establish a logistics chain to form an enterprise's own operation. Modern port logistics enterprise has shifted their running model from single service function (loading and unloading and storage) to the multi-functional service system including packing and processing, allocation, transportation and distribution, providing the cargo owner with high quality and low price and high quality service, bringing more value for the import and export goods service, and gradually realize center on the loading and unloading transportation. The traditional single function has been transformed into a modern logistics service center with multiple functions. After many years of operation, the Beibu Gulf port has formed a number of large logistics enterprises such as Sinotrans Guangxi Beibu Gulf Logistics Co., Ltd., Guangxi Beibu Gulf Weijie Logistics Group Co., and Guangxi Beibu Gulf Logistics Co., Ltd.

3.6.4 Container route

At present, Guangxi Beibu Gulf port has a well-developed shipping network and its business has covered the whole world. There are more than 100 countries and regions with international port navigation, more than 200 navigable ports, and 7 countries in the ASEAN region such as Indonesia, Malaysia and other ASEAN countries. Guangxi Beibu Gulf port has

become the frontier of China's opening up cooperation and interconnection with ASEAN. As of June 2017, Guangxi Beibu Gulf port of has opened 39 internal trade routes, including 27 foreign trade routes (as shown in table 3-4), covering ASEAN's Singapore port, Lin Chaban port, Haifang port, Guandan port, Danang port, Hu Zhiming port, Basheng port, Jakarta port and Gui Ren port.

Table 3-4 Main foreign trade container routes in Beibu Gulf port

No.	Ship company	route	Timetable	Shipping space(TEU)
1	MSC	Qinzhou-HongKong-Fuzhou/Shantou-HongKong-Haiphong-Qinzhou	Monday	2045
2	SITC	Qinzhou-Haiphong-Shekou-Xiamen-Inchon-Pyeongtaek-Dashan-Qingdao-Shanghai-Xiamen-HongKong-DaNang-Ho Chi Minh-Lin Chaban-Jakarta-Lin Chaban-Ho Chi Minh-Qinzhou	ETC. Monday, ETD. Tuesday	1032
3		Fangchenggang-HongKong/Shekou-Xiamen-Inchon-Haiphong-Fangchenggang	Wednesday	1032
4	TSL	Qinzhou-Shekou-HongKong-Tokyo-Yokohama-Nagoya-Osaka-Kobe-Keelung-Taichung-Kaohsiung-Hong Kong-Shekou-Haiphong-Qinzhou	Wednesday	1049
5	WHL	Qinzhou-Hong Kong-Nansha Islands-Basheng port-Haiphong-Qinzhou	Thursday	1234
6	PIL	Qinzhou-DaNang-QuyNhon-Singapore-Kuantan-Haiphong-Qinzhou	Thursday	1880
7	OOCL	Qinzhou-HongKong-Dachan bay-Haiphong-Qinzhou	Friday	1500
8	RCL	Qinzhou-Hong Kong-Ho Chi Minh-Singapore-Yangon-Yangon- Haiphong-Qinzhou	Saturday	1000
9	EMC	Qinzhou-Zhanjiang-HongKong-Shekou-Haiphong-Qinzhou	Saturday	1164
10	COSCO	Qinzhou-Yangpu-Zhanjiang-Gaolan-HongKong-Yantian-Shekou-Ho Chi Minh-Singapore-Quy Nhon-Haiphong-Qinzhou	Sunday	1400
11	Changhai shipping company	Fangchenggang-Sanxie Port(Vietnam)	2shifts per month	224

12	X-PRESS	WIN Channel：PIPAVAV-Colombo-Kelang-Singapore-CaiMep-Qinzhou-HongKong-Ningbo-Shanghai-Shekou-Singapore-Kelang-Nava Shiva-PIPAVAV	Wednesday	6000
13		Sea shuttle bus (to Haiphong)：Qinzhou - Haiphong	2times per week	700
14	Modern merchant shipping company/Tian Jing shipping company	Inchon-Busan-Hong Kong-Haiphong-Qinzhou-Hong Kong-Xiamen-Inchon	Sunday	1000
15	Hongkong Yongfeng shipping company	Qinzhou-Hong Kong	2 /Week	200-250
16	Hongkong Yongfeng shipping company	Fangchenggang-Hong Kong	1 /Week	200-250
17		Beihai-Hong Kong	2 /Week	200-250
18		Qinzhou-Hong Kong	2 /Week	210
19		Fangchenggang-Hong Kong	1/Week	150
20		Beihai-Hong Kong	2 /Week	210
21	Guangzhou Hengfu logistics company	Qinzhou-Hong Kong-Shenzhen	1 /Week	180
22		Fangchenggang-Qinzhou-Hong Kong-Shenzhen	1 /Week	180
23	Beihai Hao Chen international logistics company	Beihai-Hong Kong	Thursday/Saturday	90
24	Guangxi Litong logistics company	Beihai-Hong Kong	Tuesday/Friday	90
25	Wuzhou shipping	Beihai-Hong Kong	Uncertain	200

	company			
26	Beihai Kai Hong shipping company	Beihai-Hong Kong	Uncertain	45
27	Xiamen dada shipping company	Beihai-Hong Kong	Uncertain	158

Source: Qinzhou port Administration and Qinzhou development and Reform Commission

3.7 Port operation efficiency

The operation efficiency of Beibu Gulf port is relatively low. There are few special roads for direct railways in the port area, and there is a section of local railway between Fangcheng port, Qinzhou port and Beihai port. The connection between ports and trunk lines, highways and stations are inadequate, inefficient and insufficient. Number 1-4 berth of Tieshan port has been completed and put into operation in the case of the main port area collection and transportation, but the jade iron line in the railway channel is still not built in the rear. The railway line has not started yet, and the development of the port is seriously restricted by the construction progress of the railway passage. At present, there is only one highway in the rear of the Dalan Ping port area in Qinzhou port. The construction of the railway for the bonded port area is slow. At present, the railway can only go to the old Qinzhou port, and need to use truck to enter the bonded port area for second time transfer. With the completion of deep-water port in the port area, the passage will be tending to be tense. For Yuwan port area of Fangcheng port, the railway capacity is sufficient, but the capacity of loading and unloading station is insufficient; the adjacent layout of the port district, the overlap of the development space of the port and city, the traffic problems are becoming more obvious.

In some old port areas, the shared channels between urban and rural areas have intensified the contradiction between cities and towns thus the port collection and distribution are inefficient. Fangcheng Yuwan port, Qinzhou Jingu port and Beihai Shiling port are close to the urban area, and the common passageway of goods collection and transportation and

urban life on one hand aggravating urban congestion on the other hand, thereby increasing urban pollution and social risk. The overlapping of the space between port and city leads to the increasingly prominent contradiction of road traffic. With the rapid development of port rear cities, the utilization of routing resources in planned port collection and distribution channels is becoming more difficult.

3.8 Economic level and institutional environment

In 2009, the Ministry of transport approved the merger of Beihai port, Fangcheng port and Qinzhou port as Guangxi Beibu Gulf port. In the new period, the Guangxi district established a new system port management of being unified, coordinated and efficient, which carried out unified planning, unified construction and unified management of the "three unified management" of the ports in the three cities of Qinzhou, Fang Chenggang and Beihai. The construction of the port system environment has laid a good institutional mechanism for enhancing the scale efficiency, giving full play to the comparative advantage and creating a clear division of labor between the three ports of the labor division, and is conducive to building the "Beibu Gulf port" brand by the joint force. The port system environment includes the general system environment, the political system environment, and the port system environment among others.

3.8.1 Economic level

Beibu Gulf port is located in the Beibu Gulf Economic Zone. From 2006 to 2016, GDP in the Beibu Gulf Economic Zone was 141.81 billion yuan at the beginning of its establishment, to 586.73 billion yuan in 2016, fiscal revenue increased 4.54 times, 3 times the throughput of port goods, 3 times the increase of trade import and export, and accounts for half of Guangxi's foreign trade. The economic comprehensive strength of the Beibu Gulf Economic Zone has been significantly improved, the strategic position of regional development has been continuously promoted, and the opening and cooperation with the surrounding areas was advanced pragmatically, while the first test of reform and innovation has highlighted the bright spots. Beibu Gulf is not only the core growth pole to lead Guangxi

and to accelerate its development, but also one of the most dynamic and fastest developing coastal regions in China. It has become one of the most closely linkage and most effective regions among China and ASEAN.

In the "13th Five-Year plan" of Guangxi, the total economic volume of the four cities in the Beibu Gulf Economic Zone will account for more than 40% of total Guangxi in 2020. The Beibu Gulf will also strive to achieve "three over 10000", that is, gross domestic product value over 1 trillion yuan, industrial output value above scale all over 1 trillion yuan, and the per capita GDP exceeds 10 thousand US dollars. The growth of major economic indicators such as high and new technology industry, modern service industry, coastal port throughput, and urban and rural residents' per capita income should be in the forefront of Guangxi in "13th Five-Year".

New breakthroughs have been made in the construction of major projects. A number of major projects such as SINOPEC's Beihai oil refinery transformation, Qinzhou Grain and Oil Processing of COFCO, Nanning power plant, and Zhongyi Heavy Industry of Fang Chenggang were completed. The first phase of the supporting project of CNPC Qinzhou Refinery have started the construction. Fang Chenggang Red Sand nuclear power plant and other projects continue to push forward smoothly. Nanning to Qinzhou high speed railway is formally laid out. The growth rate of port cargo throughput ranks top 2 in the ports above the national scale, second only to the Huanghua port of Hebei. The bonded logistics is completed in a comprehensive way and operating well. The Qinzhou bonded port has been operating in a comprehensive way and has become the fifth vehicle import port in China's coastal areas.

3.8.2 Institutional environment

In 2015, the port authority of Beibu Gulf of Guangxi was established to manage the planning, construction and operation of Guangxi Beibu Gulf port. In 2016, the Beibu Gulf port authority assumed the responsibilities of the people's Government of Fang Chenggang, Qinzhou and Beihai, and the Beibu Gulf port authority returned the authority and responsibility of the Municipal Administration of port administration. The sub Bureau under the Beibu port authority is named "Guangxi Zhuang Autonomous Region Beibu Gulf port

authority Fang Chenggang (Qinzhou/Beihai) sub bureau". The establishment of the Beibu port authority has enabled the Beibu Gulf port of Guangxi to take advantage of its use. In recent years, Beibu Gulf Port has used major industry development special funds to support the development of steel, metallurgy, petrochemical and other major industries on the sea. It gradually played the development of industrial cluster on the sea of Fang Chenggang Jinchuan and Beihai Chengde, Qinzhou PetroChina and Longtan Zhong Jin and Beihai SINOPEC and other leading enterprises, and stimulated the port throughput increasing steadily.

The government of the state and the Guangxi autonomous region attached great importance to the construction and development of the Guangxi Beibu Gulf port. And have formulated preferential policies to support the construction and development of the port, and have introduced a number of preferential policies for the investment of the port construction projects. First, we can enjoy the preferential investment policies granted by the central and Guangxi government. Second, we can enjoy preferential policies for the implementation of the Western Development Strategy. Third, we can enjoy preferential policies such as policies for open investment, tax and land use, and flexible local preferential policies formulated by the local government as the open cities along the coast and the border.

Guangxi Beibu Gulf port, as a national port, has relatively complete port facilities. Customs and maritime affairs, inspection and quarantine, frontier inspection and border defense facilities are not only complete, but also have good service and fast customs clearance. In addition, the Guangxi Beibu Gulf port has under the jurisdiction of a comprehensive service system that formed by Qinzhou port, Fangcheng port and Beihai port, provide services such as ship towing, supply and agency, foreign cargo, financial insurance and pilotage and communication. At present, Guangxi has basically realized the extension of regional customs clearance cooperation and key port customs clearance time, implemented the goal of "single window", "three one" and "six cities and one customs", and the ASEAN countries expressed their response and support to the "two state one inspection" mode implemented in Guangxi Beibu Gulf Port.

In 2017, Beihai Port realized the opening of the port and the opening of the city. At the

same time, Qinzhou Port also opened to the outside world. Fangcheng port will realize the wider opening during the follow-up time. Qinzhou port, Fangcheng port and Beihai port together will realize the "single window" target.

Further, in order to better grasp the current institutional environment in Guangxi, we have obtained the “China Provincial Marketization Index Report 2016” (hereinafter referred to as “China Marketization Index”) reflecting the institutional environment to illustrate the development of Guangxi's institutional environment. The index was compiled by Wang Xiaolu, Fan Gang and Yu Wenjing, which was used in a large number of theoretical and empirical analyses by Chinese scholars. Therefore, we use the “General market index score” in the “China Marketization Index” compiled by Wang Xiaolu et al. (2017) to conduct a brief analysis of the Guangxi institutional environment.

In the "China Marketization Index", the "Marketing Total Index Score" gives the trend chart of Guangxi's 2008-2014 Guangxi Marketization Index.in Guangxi, although the general marketization index score decreased in 2009 and 2011, the overall marketization index score showed a gradual upward trend with the passage of time. It rose from 5.67 in 2008 to 6.51 in 2014. This indicates that the institutional environment of Guangxi, which evaluated by the general market index score, is gradually improved, the institutional environment is continuously optimized, and shows a good development trend. The four cities of Beibu Gulf Economic Zone (Nanning, Qinzhou, Beihai and Fang Chenggang) are the most active and open regions in Guangxi's economic development. With the advancement of marketization, the level of their institutional environment has also been continuously improved. On the other hand, from a national perspective, Guangxi's market-oriented general index score is still low among 31 provinces, autonomous regions and municipalities. The marketization level is still low, and the institutional environment needs further optimization. For example, in 2014, the Guangxi Marketization Index score was 6.51, and ranked 17th among 31 provinces, autonomous regions and municipalities. Although it is higher than Shanxi (5.27), Hainan (5.95) and Yunnan (4.94), but far lower than Shanghai (9.77), Guangdong (9.35) and Beijing (9.08). Therefore, the development of the institutional environment in Guangxi is still not high and needs to be improved.

[This page is deliberately left blank.]

Chapter 4: Empirical Analysis

4.1 Research object

This study takes Beibu Gulf port in Guangxi as the research object, mainly including three ports namely Fangcheng port, Qinzhou port and Beihai port with two sets of data. This research model is firsted tested with second-hand data obtained from *Chinese port Yearbook, China Statistical Yearbook,* the National Statistics Bureau website, the corporate reports published by the various port groups over the years and statistics bureaus of the provinces and cities. In order to further study and compare the competitiveness of the Beibu Gulf port in Guangxi, the other 12 ports, namely Beibu Gulf port, Yantian port, Zhuhai port and Xiamen port, Ningbo port, Shanghai port, Nanjing port, Rizhao Port, Lianyungang port, Tangshan port, Tianjin port, Dalian Port and Yingkou port, are brought into our research systerm. We discussed the competitiveness of the Beibu Gulf port in Guangxi and its competitive position among the main ports in China. In addition, in order to validate and explain the results from the research model and hypotheses testing, this study further collected first data with questionnaire from managers and employees of Beibu Gulf port. The results of the survey will be used as ancillary materials to verify and explain the research results of the competitiveness of Beibu Gulf port further. The detail of this part of study is attached in the appendix.

Therefore, this study focuses on the following four aspects: (1) the measurement of port competitiveness (port efficiency); (2) the impact of port competitiveness (port efficiency) on port throughput; (3) the impact of port facilities conditions, port connectivity conditions and port operation efficiency on port competitiveness (port efficiency) (4) the impact of institutional environment on the relationship between port throughput and port competitiveness (port efficiency).

4.2 Construction of econometric regression model

According to the theoretical model of port resources and institutional environment built in the literature, port resources have an impact on port throughput through port competitiveness, port competitiveness play the role of mediating variable. At the same time, the institutional environment is defined as moderating variable in the theoretical model which affects the direction (positive or negative) and strength of the relationship between port resources and port competitiveness, and also affects the direction (positive or negative) and strength of the relationship between port competitiveness and port throughput (see Figure2-1). In order to explore the mechanism of how port resources and institutional environment enhance the competitiveness of Beibu Gulf Port of Guangxi, taking into account the availability of data, an empirical model for verifying the rationality of the above theoretical model was constructed at first. Then, the regression equation is established respectively to test the nine hypotheses proposed in the previous article.

According to the discussion of Wen, Kittai and Chang (2005) on the moderating effect and mediating effect, the following three steps are used to verify the port competitiveness has the mediating effect and the Institutional environment can play a role of moderating effects. First, in view of the studied variables are all continuous variables, the regression equations (4.1), (4.2) and (4.3) will be set up in turn, which can be used to synthetically analyze whether port competitiveness can play an mediating role on the relationship between port and port throughput. Secondly, regression models with interaction terms (Jie Fang et al, 2015) are set up in which, equations (4.4) and (4.5) are used to prove whether the institutional environment can moderate the relationship between port resources and port competitiveness; equations (4.6) and (4.7) are used to prove whether the institutional environment can play a moderating role on the relationship between port competitiveness and port throughput. Finally, combined with the regression analysis results of the two effects, we can judge whether there is moderating effect and mediating effect in the model.

It is necessary to explain that in the regression equation for the test of the mediating effect, $Throughput_{it}$ represents the throughput of port i in year t, $Competitveness_{it}$ represents

the port competitiveness of port i in year t, and $Resource_{it}$ represents the port resource conditions of port i in year t. In the regression equation for the test of moderating effect, in addition to the above mentioned variables, $Institution_{it}$ represents the institutional environment of port i in year t, and $Resource_{it}$*$Institution_{it}$ represents the interaction term of port's institutional environment and port resources of port i in year t, which is used to observe the moderating effect of the institutional environment on the realtionship of port competitiveness and port resources. Compe $Titveness_{it}$*$Institution_{it}$ represents the interaction term between the institutional environment and the competitiveness of port i in year t, which is used to observe the moderating effect of the institutional environment on the realtionship of port throughput and port competitiveness. α_{it} is a constant, β_{it}, λ_{it} and φ_{it} are the correlation coefficients of independent variables, and μ_{it} refers to the random interference term of the regression equations.

Table 4-1 Empirical model of moderating effect and mediating effect

Model	Regression Equation	Order
Mediating Effect Regression Model	$\mathbf{Throughput}_{it}=\alpha_{it}+\beta_{it}\mathbf{Resource}_{it}+\mu_{it}$	(4.1)
	$\mathbf{Competitveness}_{it}=\alpha_{it}+\beta_{it}\mathbf{Resource}_{it}+\mu_{itt}$	(4.2)
	$\mathbf{Throughput}_{it}=\alpha_{it}+\beta_{it}\mathbf{Competitveness}_{it}+\lambda_{it}\mathbf{Resource}_{it}+\mu_{it}$	(4.3)
Moderating Effect Regression Model (1)	$\mathbf{Competitveness}_{it}=\alpha_{it}+\beta_{it}\mathbf{Resource}_{it}+\lambda_{it}\mathbf{Institution}_{it}+\mu_{it}$	(4.4)
	$\mathbf{Competitveness}_{it}=\alpha_{it}+\beta_{it}\mathbf{Resource}_{itt}+\lambda_{it}\mathbf{Institution}_{it}+\varphi_{it}\mathbf{Resource}_{it}*\mathbf{Institution}_{it}+\mu_{it}$	(4.5)
Moderating Effect Regression Model (2)	$\mathbf{Throughput}_{it}=\alpha_{it}+\beta_{it}\mathbf{Competitveness}_{it}+\lambda_{it}\mathbf{Institution}_{it}+\mu_{it}$	(4.6)
	$\mathbf{Throughput}_{it}=\alpha_{it}+\beta_{it}\mathbf{Competitveness}_{it}+\lambda_{it}\mathbf{Institution}_{it}+\varphi_{it}\mathbf{Competitveness}_{it}*\mathbf{Institution}_{it}+\mu_{it}$	(4.7)

If the empirical model of table 4-1 is verified, it is considered that, theoretically, port competitiveness play a moderating role on the relationship between port resources and port throughput, and the institutional environment can play a moderating role on the relationships between port resources, port competitiveness and port throughput. Then, the regression equations will be constructed respectively to discuss the relevant issues of the competitiveness of Beibu Gulf port.

First of all, according to the views of the resource theory, both tangible and intangible resources can give full play to their advantages to enhance the competitiveness of the resources owners. Cho et al. (2015) holds that port resources include tangible port facilities conditions, route connectivity conditions and intangible port operation efficiency. Referring to the practice of Cho et al. (2015), first, a cross sectional variable coefficient model of port resources affecting port competitiveness is constructed as follows:

$$\textbf{Competitveness it}=\alpha i+\beta i\textbf{Facility it}+\lambda i\textbf{Route it}+\varphi i\textbf{Efficiencyit}+\mu it \quad (4.8)$$

Where，$Competitveness_{it}$ represents the port competitiveness of port i in year t, $Facility_{it}$ represents the port facilities conditions of port i in year t. $Route_{it}$ represents the port routes connection conditions of port i in year t. $Efficiency_{it}$ represents the port operation efficiency of port i in year t. α_i represents other factors that change with the region, μ_{it} refers to the random interference term. β_i , λ_i and φ_i are the correlation coefficients of independent variable. This study focuses on β_1 , λ_1 and φ_1 which are the regression coefficient of port facilities conditions, port connectivity conditions and port operation efficiency in Beibu Gulf port. According to the foregoing hypothesis, if the port resources condition of Beibu Gulf is relatively perfect, it will enhance the competitiveness of the port. Then β_1, λ_1 and φ_1 should be positive and statistically significant.

Secondly, a cross section individual variable coefficient model of port competitiveness affecting port throughput can be constructed as follows:

$$\textbf{Throughput}_{it}=\alpha_i+\beta_i\textbf{Competitveness}_{it}+\mu_{it} \quad (4.9)$$

where，$Throughput_{it}$ represents the throughput of port i in year t. According to the hypothesis 1, if the port competitiveness of the Beibu Gulf port is stronger, the port throughput will be increased. Then β_1 should be significantly positive.

Next, for examine the direction (positive or negative), strength of institutional environment impact on the relationship between port resources and port competitiveness in the Beibu Gulf port, the regression model is set up as follows:

$$\textbf{Competitveness}_{it}=\alpha_0+\beta_1\textbf{Facility}_{it}+\beta_2\textbf{Route}_{it}+\beta_3\textbf{Efficiency}_{it}+\beta_4\textbf{Institution}_{it}$$
$$+\lambda_i\textbf{Facility}_{it}*\textbf{Institution}_{it}+\varphi_i\textbf{Route}_{it}*\textbf{Institution}_{it}+\Phi_i\,\textbf{Efficiency}_{it}*\textbf{Institution}_{it}+\mu_{it} \quad (4.10)$$

The key coefficients in the model are interaction term coefficients: λ_{it} , φ_{it} and Φ_{it}. If the institutional environment in the Beibu Gulf port can moderate the direction (positive or negative) and the strength of the relationship between port resources and port competitiveness, then β_1 , λ_1, φ_1 , Φ_1 should be statistically significant. According to the hypothesis, if the institutional environment in the Beibu Gulf port can positively regulate the relationship between port resources and port competitiveness, then β_1, λ_1、 φ_1 , Φ_1 should be significantly positive.

Finally, the following models are established to verify the institutional environment impact on the relationship between port competitiveness and port throughput in the Beibu Gulf port.

$$\mathbf{Throughput_{it}=\alpha_0+\beta_1 Competitveness_{it}+\beta_2 Institution_{it}+}$$

$$\mathbf{\lambda_i Competitveness_{it}*Institution_{it}+\mu_i} \quad (4.11)$$

According to the hypothesis, if the institutional environment in the Beibu Gulf port can positively regulate the relationship between port competitiveness and port throughput, λ_1 the interaction term coefficient of the Beibu Gulf port institutional environment and the port competitiveness should be significantly positive.

4.3 Variable measurement

4.3.1 Independent variable measurement

The independent variables of this study are port resources, which include three indexes. They are port facilities conditions, port connectivty conditions and port operation efficiency. The selection basis and measuring methods of the three indexes are as follows:

4.3.1.1Measurement of port facilities conditions

Port facilities refer to wharf, breakwater, Levee and revetment, port pool, port channels, anchorage, port road and yard, warehouse, railway and handling machinery track, protection facilities, other production facilities and auxiliary facilities for production. Wharf shoreline is the intersection line between the vertical plane and the horizontal plane on the side of the

wharf. It is the length of the coast for ship docking, an important baseline for determining the location and elevation of the wharf. The designed throughput capacity refers to the maximum transport volume that may be passed through a certain control section of the channel during the computation time. The cost of port production and operation refers to the cost that the port group company sells goods or provides labor services for maintaining normal production and operation (People's Republic of China Ministry of Communications, 2006). From the above concepts, the port facilities determine the level and potential of the development of port. The high quality port facilities and the rich wharf shoreline and other resources are the basis for the healthy development of the port.

With regard to the measurement of port facilities, different scholars have used different index systems to measure it. For example, in measuring the competitiveness of China's port, Zheng (2008) holds that the port competitiveness is mainly composed of three aspects: the competitive advantage of the resources, the competitive advantage of the structure and the competitive advantage of the ability. In terms of resource competitive advantage, a port facility is considered as an important resource and is measured by three indicators: the length of wharf shoreline, the number of berths and the number of port handling machiners. The factor analysis was used by Yu, Yin and Tong (2011) to evaluate the competitiveness of China's cruise port. It is considered that the competitiveness of the cruise port itself is an important aspect to reflect the competitiveness of the cruise port. The competitiveness of cruise ports mainly includes the water depth at the front of the pier, the depth of the port channel, the number of deep-water berths and the number of incoming cruises. Gorden’s (2005) research shows that berths and hinterland resources are important factors affecting port competitiveness. Zhao et al. (2015) analyzed the efficiency of the integrated resource allocation of the port, measured the input of the integration of the port resources by 5 indicators: the designed throughput capacity, the length of wharf shoreline, the area of the anchorage, the cost of the port production and operation, and the cost of the port government management. Cho et al. (2015) used wharf and yard to measure facilities when they measure port resources. Zhao et al. (2016) studied the integration decision-making mechanism of port ecological niche resources by weighing the natural resources with port channel, anchorage

and coastline, measuring the resources of the market with the hinterland of the goods, and measuring the social and economic resources by capital, policy and organizational resources.

Teng et al. (2017) believe that port condition competitiveness is one of the 5 comprehensive factors which affect port competitiveness. Port condition competitiveness is a comprehensive reflection of port facilities. In order to better reflect the competitiveness of China's port conditions, 5 indexes are used to measure the facilities conditions of China's ports. They are the number of berths, the number of ten thousand tons berths, the length of berth, the number of loading and unloading machines and the number of container liner routes. Li (2017) used berth shoreline length, berth number, ten thousand tons berth number and annual throughput to measure the level of port facilities when evaluating the comprehensive competitiveness of China's ports. Similarly, Wei et al (2017) evaluated China's port competitiveness with indexes of port berth, ten thousand tons of berth and the length of pier berth to measure port facilities. Zhao et al. (2018) used the Principal Component Analysis to explore the competitiveness of the main coastal ports in China in which the total length of the port wharf, the total number of port production berths, the total number of port berths and the total number of ten thousand tons berths used in the port production are used as the indicators to measure the port facilities.

From forgoing review, it can be seen that, base on different research purpose, in measurement of port facilities conditions, the number of berth, the length of the wharf shoreline, the number of port loading and unloading machiners the designed throughput capacity are mainly adopted as indicators by scholars. In this study, when we explore the impact of port facilities on port competitiveness combined with the content of the resource theory, considering the availability of data, we uses the length of the wharf shoreline, the designed throughput capacity, and the cost of port production and operation to measure the port facilities conditions. Generally speaking, the longer the length of wharf production shoreline and the bigger the capacity of designed channel thoughput, the better the conditions of port facilities, and vice versa.

4.3.1.2Measurement of port connectivity conditions

The port connectivity conditions mainly refer to the cargo turnover capacity and

transportation capacity of the port. Foster (1978) holds that the port tarriff, service quality and convenience, the number and density of the routes, and the waiting time of the port are the important factors that affect the competitiveness of the port. Claudio Ferrari (2006) believes that the number and density of the routes are the ties and bridges connecting the import and export of goods in each country. The more the number and the greater the density of routes, the more convenient the port is to connect. Jose (2005) evaluates port competitiveness by means of port operation efficiency, route density and hinterland economic development. It is found that port operation efficiency, route density and hinterland economic development are positively related to port competitiveness. Base on the resources theory and the institutional environment view, Cho et al. (2015) tested the impact of port resources on the port competitiveness.They hold that it is the route that connected the ship network of all countries in the world. Therefore, they believes that the port connectivity conditions is an important factor affecting the port competitiveness, and uses the number of ships, the volume of ships, the number of logistics companies as indicators to evaluate the port connectivity conditions. Since we are going to use data of 13 ports in our study, and the number and density of routes of Beibu Gulf port (Qinzhou port, Beihai port and Fangcheng port) can only get 2015, 2016 and 2017 data. Therefore, the port connectivity conditions are measured by the number of port logistics companies. Generally speaking, the more port logistics companies, the better the port connectivity conditions.

4.3.1.3Measurement of port operation efficiency

Given that environment should have the same or similar effect to all the enterprises in it. The quatity, quality and efficiency of the resources owned or controlled by the enterprises are the main reasons which lead to the difference of the competitive strategy performance between enterprises (Ge & Xiao, 2007). As a result of the comprehensive operation of port enterprises using port resources such as equipment and technology, port operation efficiency naturally was paid close attention to the resources theory and has become an important aspect of the academic world to explore the impact of internal resources on enterprise competition strategy. Base on Barney`s (1991) division of tangible and intangible resources, Cho and Kim’s (2015) analysis of port competitiveness at transnational level considers port

infrastructure as tangible resources, port operation efficiency and port connectivity conditions as intangible resources, and adopts port facilities conditions, port connectivity conditions and port operation efficiency together as indicators to measure port resources. Teng et al (2004) evaluated the competitiveness of ports in Asian and pointed out that the port operation efficiency included port execution, operation efficiency of dock and container freight system. It is not only the input index of port competitiveness assessment together with port facilities, human resources and information, but also the output index of port enterprises using berths, cranes and warehouses in production and operation.It is the concrete embodiment of port resources` operation efficiency. Huang et al. (1997) divided the port system into efficiency and effectiveness. Efficiency is the working efficiency of various facilities, such as wharves and container freight stations, the operation efficiency of various resources. And the effectiveness is the final result. Therefore, Teng et al (2004) took port operation efficiency as an important port resources indicator, as same as port facilities conditions, to measure port competitiveness. Using the reference of Huang et al. (1997), Cho et al. (2015), Teng et al.'s (2004) research results and the resources theory, in this study, we measure port resources not only with tangible resources such as the port facilities conditions, intangible resources such as port connectivity conditions, but also operation efficiency of tangible resources and intangible resource (the management efficiency of the port) as intangible resources. Enterprise operation efficiency refers to the efficiency of enterprises in using assets, which is directly related to the success or failure of enterprises and has always been an important part of financial analysis. It`s measurement includes corporate profitability, asset utilization efficiency and value added (He Zhidong et al. 2010). It will be measured from the perspective of enterprise profit in this study. This study takes the ratio of operational profit to total assets as the indicator to measure the efficiency of port operation. The higher the ratio is, the better the port operation efficiency is.

4.3.2 Measurement of mediating variable

Port competitiveness is the mediating variable of this theoretical model. The measurement of port competitiveness has become a special subject of competitiveness research, which involves not only the methods of economics and management, but also needs

to be presented by statistical index system. Jin (2003) thinks that the evaluation index of competitiveness consists of measuring index and analyzing index. Measuring index is an outcome of competitiveness or the final expression of competitiveness; however, analyzing index is a cause or a key element of competitiveness. Jin (2003) believes that measuring index, especially display indices, is an outcome of competitiveness or the final expression of competitiveness, however, analyzing index is a cause or a key element of competitiveness. At the same time, it is pointed out that "from the perspective of theoretical economics, the essence of competitiveness is productivity or economic efficiency" and "in the sense of economic, the understanding of competitiveness must include the meaning of efficiency". Especially in the current market economy, the port is one of the economic subjects of rational development. Its goal cannot deviate from the pursuit of maximum profit. It always hope to achieve this goal in the most efficient ways and means (Xie, 2004). Therefore, it is considered as a feasible method to evaluate port competitiveness by using efficiency. Fall (1994) believes that efficiency is a measure of how an enterprise, in accordance with its behavioral goals translates its input into output, under the constraints of the production technology structure, allocate all resources in an effective way. Martinez-Budria et al.(1999) divided 26 ports into three groups, namely low complexity group, medium complexity group and high complexity group. DEA-BCC model was used to figure out the efficiency of these 26 ports. It is found that the ports of the high complexity group have high efficiency, and the ports of the medium complexity group and the low complexity group have moderate and low efficiency. Hu and Huang (2007) used the super-efficient DEA model to measure the scientific and technological competitiveness of large and medium-sized industrial enterprises in 30 provinces (cities and districts) in China, and conducted correlation analysis on the environmental factors of the scientific and technological competitiveness of enterprises. DEA was used by Pang (2006) to conduct an overall analysis and evaluation on the operation efficiency of 50 major coastal ports in China from 1999 to 2002. Malmquist productivity index was used to analyze and evaluate the efficiency changes of these 50 coastal ports.

Base on above researches, from the perspective of efficiency, the port competitiveness evaluation index system of 13 ports of China including the Beibu gulf port was set up. This

solved the shortcomings of research on port competitiveness evaluation index system in existing literature. Next, with the DEA method, 13 port competitiveness evaluation models is established to do empirical analysis which shows the efficiency based position of Beibu Gulf port in the same industry and then explain its port competitiveness.

4.3.2.1Basic principle of evaluating port competitiveness based on efficiency

Up to now, parametric method and non parametric method can objectively evaluate port efficiency very well. Using the parameter method, the setting of the boundary function has a strong subjectivity, and the accuracy of the function form will have a great influence on the final efficiency value. Data Envelopment Analysis (DEA), as the representative of non parametric method, is characterized by the fact that the specific function do not have to be set in advance, and it can avoid the dependence of the concrete function form when it is actually applied. Without subjectively giving weight to the relevant indexes, it has a strong objectivity.

DEA is a mathematical programming method for evaluating the relative efficiency of multiple input and output decision making units. It belongs to the new field of interdisciplinary. It defined the economic system, which “putting into a certain quantity of production factors and producing a certain number of products after the decision”, as Decision Making Unit (DMU). DEA efficiency is the efficiency of a DMU relative to other DMU s. In the process of analysis and evaluation, data are based on DMU's “input” and “output”. Here the data of “input” and “output” are known as input and output in the process of production. DEA uses the mathematical programming method to find the efficiency frontiers which can contain all the observation data, next, calculates the distance between the observation value of each DMU and the efficiency front surface, and then the efficiency level of each DMU can be obtained respectively. Without considering the random error, if the observation value of the DMU can fall on the efficiency front surface, the DMU has complete efficiency and the efficiency value is 1. If the observation value of the DMU does not fall on the efficiency front, the DMU is relatively inefficient and the efficiency value is between 0~1. The gap expresses the degree of inefficiency. According to this, we can sort the DMU according to the efficiency relative efficiency, then find the reason and degree of the gap between the non effective DMU and the effective DMU, and provide the important reference for the policy makers for the policy

making.

4.3.2.2Port competitiveness evaluation model based on efficiency

(1) Establishment of the evaluation index system. The efficiency analysis of port activities must take into account that the activities of the port are multifaceted. That is, different types of commodities need to use production resources in a very unique way. Like many industries, ports also use labor and capital to produce port services. So what`s it in put is labor and capital. Different types of ports have different forms of capital investments such as transport tools, port facilities, and warehouses. So in order to reflect the different capital invested by different ports, we need to choose a unified index to measure it. DEA method asks for selecting comprehensive indicators which can reflect the overall executive force to evaluate port competitiveness. In the selection of input and output indicators, the most important thing is to choose the index that can reflect the port competitiveness and meet the requirements of the port efficiency evaluation. At the same time, the availability of data should be taken into account, and make sure the sum of the number of input and output indexes is less than the number of DMU. We measure port input indicators mainly from three aspects of labor, capital and land. Where，the total length of berth, the number of container berths and the number of cranes are more important in the capital investment term (Teng-Fei et al, 2003; Valentine & Gray, 2001). Yard area and human capital are often emphasized by some scholars (Roll & Hayuth, 1993; Tongzon, 2001). From the angle of cost, Martinez-Burdia (1999) considered the input of the port which includes labor expenditure, depreciation expense, “other expenditure”, and the last part is intermediate input and service. In the existing literature, cargo throughput is used as an output indicator. Some other terms are listed in the output indicators, such as port profit and user satisfaction. With regard to the selection of input and output indicators of China's ports, this study follows the research experience of Valentine and Gray (2001) and Teng-Fei et al. (2003). The length of the shoreline and the number of berthes are selected as the port input index. The number of port containers and the total cargo throughput are selected as the output index.

(2)Evaluation model of port competitiveness base on DEA. Thirteen ports in China, including Beibu Gulf port, are evaluated in this model. Each port which is evaluated is

recorded as a DMU. Every DMU has 2 inputs and 2 outputs. If the ith DMU is evaluated, it will be recorded as DMUi. Xij refers to the jth input of DMUi. Yik refers to the kth output of DMUi. Then all input of DMUi can be expressed as:

$$X_i = \left(X_{i1}, X_{i2}\right)^T, \left(i = 1, 2, ..., 13\right) \tag{4.12}$$

The output of DMUi can be expressed as:

$$Y_i = \left(Y_{i1}, Y_{i2}\right)^T, \left(i = 1, 2, ..., 13\right) \tag{4.13}$$

The efficiency of DMUi can be expressed as:

$$E_i = \frac{u^T Y_i}{v^T X_i} \tag{4.14}$$

Where u^T is the weight vector of the input index, v^T is the weight vector of the output index, and the weights u and v should be selected appropriately to make sure $E_i \le 1, i = 1, 2, \cdots, 13$.

If the evaluation is for the i0th DMU, it will be recorded as DMU0. Its input is X0 and output is Y0. Then the relative efficiency evaluation model of the i0th DMU is:

$$\begin{aligned} &MaxE_0 = \frac{u^T Y_0}{v^T X_0} \\ &s.t.\ u \ge 0, v = 0 \\ &\sum_{i=1}^{2} u_i = 1 \\ &\sum_{i=1}^{2} v_i = 1 \end{aligned} \tag{4.15}$$

By introducing the relaxation variable s^+, s^- and non Archimedes infinitesimal quantity ε, the model (5.4) equivalent is transformed into a linear programming CCR-DEA model according to the Charness-Cooper transformation and the dual programming theory.

$$
\begin{aligned}
&Min\left[\theta-\varepsilon\left(e_1^T s^- + e_2^T\right)\right] \\
&s.t.\ \ \sum_{i=1}^{13} X_i\lambda_i + s^- = \theta_{X_0} \\
&\sum_{i=1}^{13} Y_i\lambda_i - s^+ = Y_0 \\
&\lambda_i \geq 0, i = 1,2,...,13 \\
&s^- \geq 0, s^+ \geq 0
\end{aligned} \tag{4.16}
$$

Where, ε is a non Archimedes infinitesimal quantity, $e_1^T = (1,1,\cdots 1) \in E_m$, $e_2^T = (1,1,\cdots 1) \in E_s$, s^- is a vector composed of the relaxation variables corresponding to the input $s^- = (s_1^-, s_2^-, \cdots s_m^-)^T$, and s^+ is a vector composed of the relative relaxation variables corresponding to the output $s^+ = (s_1^+, s_2^+, \cdots s_m^+)^T$.

If convex constraints $\sum_{i=1}^{13} \lambda_i = 1$ are added to the CCR-DEA model, the BCC-DEA model can be obtained.

$$
\begin{aligned}
&Min\left[\theta^{BBC}-\varepsilon\left(e_1^T s^- + e_2^T\right)\right] \\
&s.t.\ \ \sum_{i=1}^{13} X_i\lambda_i + s^- = \theta^{BBC}{}_{X_0} \\
&\sum_{i=0}^{13} Y_i\lambda_i - s^+ = Y_0 \\
&\sum_{i=1}^{13} \lambda_i = 1 \\
&\lambda_i \geq 0, i = 1,2,...,13 \\
&s^- \geq 0, s^+ \geq 0
\end{aligned} \tag{4.17}
$$

CCR-DEA model and BCC-DEA model can distinguish port competitiveness from the perspective of efficiency.

4.3.2.3Port competitiveness based on efficiency

(1)Empirical data. For study the competitiveness of Beibu Gulf port, 12 major ports, are selected as comparison objects. The data of these 13 ports from 2010 to 2016 were collected. The data are derived from *China's port Yearbook* (2011-2017). In the input and output indexes, the berth refers to the location where the ship can dock in the port area. The number of perth

construction is appropriate or not will not only affect the port construction investment and port throughput, but also affect the state of the ship in port, the cost of loading and unloading and waiting time for loading and unloading. Shoreline refers to the coastline used for the construction of the wharf. The important symbol of the port size is the total length of the various shorelines in the port which shows the number of ships that can be docked at the same time; The port cargo throughput and the port container number are important quantitative indicator which shows the results of the production and operation of the port and is the most direct embodiment of the status, role and influence of the international water transport chain. It is also an important quantitative reference for measuring the construction and development of a country, a region or a city. The detailed original data of the input indexes (the number of berthes and the length of the shoreline) and the output indexes (the container throughput and the throughput), for measuring the port competitiveness, are attached in Appendix A.

(2)Evaluation results of port competitiveness. The efficiency measure method proposed by Farrell (1957), on the basis of the Debreu (1951) and Koopmans (1951) method, is a method which involves unitization (between the values of 0~1), can take into account a variety of inputs. However, in around 20 years after the method was proposed, this method has not received much attention. Until Charnes, Cooper and Rhodes (1978), under the condition of Constant Returns to Scale (CRS), proposed the DEA technology. And in the later literature, this method was named as the CCR model with the initial letters of Charnes, Cooper and Rhodes. This situation has been radically changed. The CCR model assumes that the return to scale of production technology is unchanged, or although the return to scale of production technology is variable, it is assumed that all the evaluated DMU are in the optimal stage of production scale, that is, in the stage of constant return to scale. But in actual production, many production units are not at the optimal scale of production. Later, a large number of documents take into account a series of other hypothesis, which extend the DEA method. Especially, Banker, Charnes and Cooper (1984) changed the hypothesis of Constant Returns to Scale into Variable Returns to Scale (VRS), and extended the DEA analysis of CRS model. They belive that effect of technical efficiency (TE) will be affected by the scale efficiency (SE) when not all DMUs run on the best scale. In the future literature, the extended

model is called the BCC model (named after the surname initial letters of the three authors--Banker, Charnes and Cooper). This model relaxes the limitation of returns to scale, improves the CCR model, and further divides efficiency into pure technical efficiency and scale efficiency.

According to the BCC model, we can compare the calculated efficiency values under different scale returns, and judge each DMU is under what kind of reward return of production scale. Refering to the BCC theory model, we design the suitable evaluation index system of port competitiveness. DEAP 2.1 software is used to calculate the relative value of the port experience efficiency. The number of period in 2010~2016 is 7. The number of input is 2, the number of output is 2. The number of DMUs is 13. Under the selection of input oriented, the results of Constant Returns to Scale Technical Efficient (CRSTE), Variable Returns to Scale Technical Efficient (VRSTE), scale efficiency value (SE) and return to scale type are presented. After arrange and sort, the results are shown in Appendix B.

Among them, the comprehensive technical efficiency value, which is the production efficiency of the input factors of DMU at a certain optimal scale, is the comprehensive evaluation of DMU`s resource allocation ability, resource utilization efficiency and other capabilities. It is equal to pure technical efficiency multiplied by scale efficiency. The integrated technical efficiency equals to 1, indicating that the input and output of the DMU are comprehensively effective, that is, the DMU are both technology effective and scale effective. Otherwise, the integrated technology is relatively inefficient.

Pure technical efficiency value, brought about by institution and management level, is the production efficiency influenced by management and technology. It is the efficiency value calculated under variable scale reward production technology. Pure technical efficiency equals 1, indicating that the resources invested in the current level of technology is efficient.

Scale efficiency value refers to the production efficiency affected by enterprise scale factors under the premise of a certain institution and management level, which reflects the difference between the actual scale and the optimal scale. The higher the scale efficiency is, the more appropriate the ratio of input to output is.

4.3.3 Measurement of moderators

In this study, institutional environment is defined as moderator in the theoretical model which affects the direction (positive or negative) and strength of the relationship between port resources and port competitiveness, and also affects the direction (positive or negative) and strength of the relationship between port competitiveness and port throughput.

What is the definition of institutional environment? People often refer to the social state composed by many institutions as the “institutional environment”. In the traditional economics, in addition to the general significance, “institutional environment” includes a more specific category and content. In *The Institutional Change and Economic Growth of the United States* (L.E Davis, and D.C noth co-authored), Institutional environment is defined as: “a series of political, social and legal rules which used to establish the basic of production, exchange and distribution”. The category of institutional environment should include all kinds of existing tangible and intangible systems, as well as the conditions, constraints and atmosphere which affect the economy, politics, culture and other aspects of social life. Thus it can be seen that the institutional environment is not exactly the same as the system. It not only has the "entity" characteristics of the system, but also has the social conditions, constraints, atmosphere and state formed by the system, that is, the characteristics of "environment". Although this “environment” feature is not as mandatory as “entity”feature, it can permeate the whole social life with strong influence. Society is just a social order. The function of each society is to contribute to a certain behavior of reciprocity; to make people do not make any kind of behavior harmful to society, and enable them to make other behaviors beneficial to society (Kelsen, 1996).

About the measurement of the institutional environment, the current domestic academia mainly selects indicators from the following several aspects: one is to use “the relationship between the government and the market”, “total marketization index” and other indicators in China's marketization index which were established by Fan and Wang (2001) as well as Xia and Fang (2005), Fang (2006, 2007); another is to use the proportion of per capita fiscal expenditure of local governments in the total per capita fiscal expenditure of governments at all levels for measurement, as according to Xu and Qiao (2012). Considering the institutional

environment which port faced all involves in the government's policy arrangement, the degree of legalization, the marketization process. So simply choose the share of fiscal expenditure per capita of local governments in per capita of total fiscal expenditure at all levels government to measure the institutional environment of port may not be able to express the whole port institutional environment. Therefore, thispaper are going to follow the institutional enviroment measuring method of Xia and Fang (2005), Fang (2006, 2007). “Total marketization index” in China's marketization index which established by Wang, Fan and Yu (2017) is adopted as indicators to measure the institutional enviroment.

It needs to be explained that the data, which included in China Provincial Marketization Index Report 2016 established by Wang, et al. (2017), come from 31 provinces, autonomous regions and municipalities during 2008~2014 in which the annual data of 2015~2016 is not available. Lagrange interpolation methode is used to supplement the missing data in this study refer to the methods of Wei and Liu (2017).

4.3.4 Measurement of dependent variable

In this study, the change of port throughput, which is considered to be the result of the change of port competitiveness, was taken as dependent variable in theoretical model. In academic community, there is same measurement of port throughput which mainly focusing on two indicators: port cargo throughput and port container throughput. For evaluating the ports competitiveness of China, Zheng (2008) measured port throughput with three indicators: the total throughput growth rate of port goods, the throughput rate of foreign trade goods and the throughput rate of container. Teng and Hu (2017) used cargo throughput, container throughput and foreign trade cargo throughput to measure port productivity when evaluating the competitiveness of China's coastal ports. For measuring the port capacity of production operation, Li (2017), in addition to the three indicators of cargo throughput, foreign trade throughput and container throughput, adopted the two indicators of passenger throughput and goods clearance of harbor. Tang et al. (2017) adopted port container throughput to represent the situation of port production and development. Constructing the port competitiveness index system, Wei et al. (2017) selected four indicators, namely port cargo throughput, container

throughput, foreign trade cargo throughput and container routes, to measure the operation scale of a port. It can be seen that container throughput and cargo throughput have become important indicators to represent the production capacity and operation scale of the port. The port cargo throughput (including container tonnage) is selected as indicator to measure the port throughput in this study.

4.4 Sample selection

In this study, the sample interval is from 2010 to 2016. Taking 2010~2016 as the sample interval which is mainly based on the following two aspects consideration. First, when we measure the port competitiveness (port efficiency) of 13 ports, although the number of berthes, the length of shoreline, the container throughput and the port cargo throughput which are related to the measurement are able to obtain data from 2010 or even prior to it, the relevant indicators of the port production and operating costs, operating profits and operating costs are derived from the financial statements or annual reports of the various port groups or companies, which are subject to the consistency of the years and data published in the financial statements or annual reports. Second, Qinzhou port, Beihai port and Fangcheng port were adjusted in 2007 by "three ports in one" and established the Guangxi Beibu Gulf port group. However, due to many reasons, we can only obtain data on production and operating costs, operating profits and operating costs after 2010. The container throughput of the Beibu Gulf port in Guangxi was only 350 thousand TEU and the port cargo throughput was only 9408 tons before 2010. Compare with other ports, its port operation scale and port production capacity are smaller, and the Beibu Gulf Port entered the fast development lane after 2010. Therefore, from this point of view, selecting the data after 2010 as research samples is more realistic and is of great practical significance. So the sample interval of this study is 2010~2016. In addition, in the study of the competitiveness of Guangxi Beibu Gulf port, in order to better analyze the competitiveness of Guangxi Beibu Gulf Port, it`s competitive position and gap in the main coastal ports in China and the impact of port resources and institutional environment on Beibu Gulf port competitiveness, we select 12 ports except for the Beibu Gulf port, namely the Yantian port, Zhuhai Port, Xiamen port, Ningbo port,

Shanghai port, Nanjing port, Rizhao Port, Lianyungang, Tangshan port, Tianjin port, Dalian Port and Yingkou port. These constitute the panel data of 13 ports for 7 years data. A total of 91 sample observations are taken as the research samples for the further systematic and comprehensive analysis of Guangxi Beibu Gulf Port competitiveness.

4.5 Data source for model testing

In the previous discussion on variables, we analyzed the measurement basis of variables. The data to test the research model are described as follows.

4.5.1 Data source of independent variables

The port facilities conditions are measured by the length of the wharf production shoreline, design of channel passing capacity and the cost of the production and operation of the port. Where, the data of the length of the wharf production shoreline of each port are from the National statistics Bureau of China (http://www.stats.gov.cn); The data of the design of the channel passing capacity (hundreds of millions tons) comes from *China Port Yearbook* where the design of the channel passing capacity of some ports is missing in 2010 which are completed by Lagrange interpolation method; The cost of port production and operation (RMB 100 million) comes from the financial statements and annual reports published by the 13 port groups over the years (2010~2016).

Based on the resource theory and the institutional environment view to test the influence of port resources on port competitiveness, Cho et al. (2015) think that it is the routes that connect the ship network of all countries in the world. The port connectivity is an important factor affecting port competitiveness. The number of ships, the volume of ships and the number of logistics companies are adopted as indicators to measure port connectivity conditions. Since data from 13 ports are used in our study, and the number and density of the Beibu Gulf port (Qinzhou port, Beihai port and Fangcheng port) can only get the data of 2015, 2016 and 2017. During the data collecting, port companis belive that routes connect bulk cargo wharfs, which can lead to all ports of the world, means nothing to our research. It is suggested that the number of port logistics companies can be used to measure port conectivity

conditions. The port conectivity conditions are represented by the number of logistics companies. The data of the number of logistics companies come from *the statistical yearbooks* of 2011~2017 in various cities.

The enterprise operation efficiency refers to the utilization efficiency of assets which directly relate to the success or failure of the enterprise. It has always been one of the important contents of the financial analysis which be used to measure the profitability of the enterprise, asset utilization efficiency, asset value preservation and appreciation. (He et al., 2010). We are going to measure port operation efficiency from the perspective of corporate profits, and use the ratio of operating profit to total assets to measure port operation efficiency. The larger the ratio is, the better the efficiency of port operation is. The operation profits and total assets of each port are derived from the financial statements and annual reports (2010~2016) published by the various port groups, Where, the missing data of the Beibu Gulf port in 2010 and 2011 and the missing data of Shanghai port in 2016 will be completed by Lagrange interpolation method.

4.5.2 Data source of mediator variable

DEA method is used to evaluate port competitiveness in this study. Based on the research experience of Valentine and Gray (2001) and Teng-Fei et al. (2003), the length of the wharf shoreline and the number of berthes are selected as the port input index; the number of port containers and the total cargo throughput are selected as the output index. The data (2010~2016) for above indice of all ports are come from *The China Port Yearbook* (2011-2017).

4.5.3 Data source of moderator variable

As mentioned above, the institutional environment faced by the port operation involves the government's policy arrangement, the degree of legalization and the degree of marketization. In view of the “general market index” in the Chinese market index, which is compiled by Fan and Wang (2017), can comprehensively reflect the relationship between the government, the development of non-state economy, the development degree of product

market, the development degree of factor market, the development of market intermediary organization and the legal system environment. Therefore, “general market index” is used to measure the institutional environment of the ports. The data source of the index comes from *Market index report of China's sub-provinces (2016)* published by Wang, Fan and Yu. The missing data in 2015 and 2016 are filled by Lagrange interpolation method.

4.5.4 Data source of dependent variable

In this study, the dependent variable is port throughput. The port cargo throughput is chosen as its measure indicator. The data of annual cargo throughput (100 million tons) (2010~2016) of the 13 ports is derived from *China port Yearbook* (2011~2017).

4.6 Statistical analysis

The descriptive statistics (mean, variance and extreme value) are used to analyze the statistical characteristics of the eight main variables used by the model; The time series trend graph is used to compare and analyze the changing trends of the four main variables of the 13 ports, especially the competive relative position of the Beibu Gulf Port; The correlation coefficient matrix is used to shows the relationship of variables (the strength of the linear correlation).

4.6.1 Descriptive statistics of data

Ninty one (91) samples are collected from 13 ports during 2010~2016. The descriptive statistic results about 8 variables of 91 samples see Table 4-2 below for details. From the table, the mean of selected indexes of ports, which are port throughput, port competitiveness, the length of wharf shoreline, port production and operation cost, design channel passing capacity, port connectivity conditions, port operation efficiency, institution enviroment, are respectively as follows: 3.122, 0.612, 29.604, 2.234, 53.048, 3704.725, 0.055 and 8.110; The standard deviations are:1.965, 0.303, 21.395, 1.428, 61.950, 4868.764, 0.031 and 1.477; The minimum value are : 0.440, 0.109, 6.214, 0.200, 0.828, 100, -0.0004 and 5.07; The maximum values are: 8.890, 1.000, 82.989, 5.920, 248.222, 17852, 0.151 and 11.530. Combined with the

measurement units of the variables, it can be seen that ports competitiveness and the institutional environment are different, but the differences are not significant; on the contrary, from mean and standard deviation of the length of wharf shoreline, the cost of port production and operation, design channel passing capacity, port connectivity conditions, port operation efficiency, it can be seen that there are great differences in different ports, especially in port operation efficiency, port connectivity conditions, the length of wharf shoreline, and port production and operation cost.

Table 4-2 Variables Descriptions

Index	code	unit	mean	standard deviation	Min	Max	sample size
throughput	Throughput	Hundreds millions tons	3.122	1.965	0.440	8.890	91
Port competitiveness	Competitiveness	-	0.612	0.303	0.109	1.000	91
The length of wharf Shoreline	Shoreline	kilo meters	29.604	21.395	6.214	82.989	91
Design throughput capacity	Channel	Hundreds millions tons	2.234	1.428	0.200	5.920	91
Port production and operation cost	Cost	Hundreds millions RMB	53.048	61.95	0.828	248.22	91
Number of logistics companies	Company	-	3704.7	4868.7	100	17852	91
Port operation efficiency	Efficiency	-	0.055	0.031	-0.0004	0.151	91
Institutional environment	Institution	-	8.110	1.477	5.07	11.530	91

4.6.2 Time series analysis of index

Figure4-1 shows us the changes of port cargo throughput in 13 ports in during 2010~2016. As shown in Figure 4-1, although the throughput of Beibu Gulf port is rising over time, there is a big gap compared with other ports, and it does not reach the average. Shanghai port and Ningbo port have the highest throughput in the 13 ports, especially Ningbo port, which maintains the highest throughput level. Zhuhai port has the lowest throughput. Compared with the developed port, the Beibu Gulf port has a very large gap not only in Container throughput but also total volume of goods

According to Figure 4-2, there are a large number of logistics companies in Beibu Gulf Port which is in the middle level. The number of logistics companies in Shanghai port is the largest. The number of logistics companies in Yingkou port and Yantian port is the lowest.

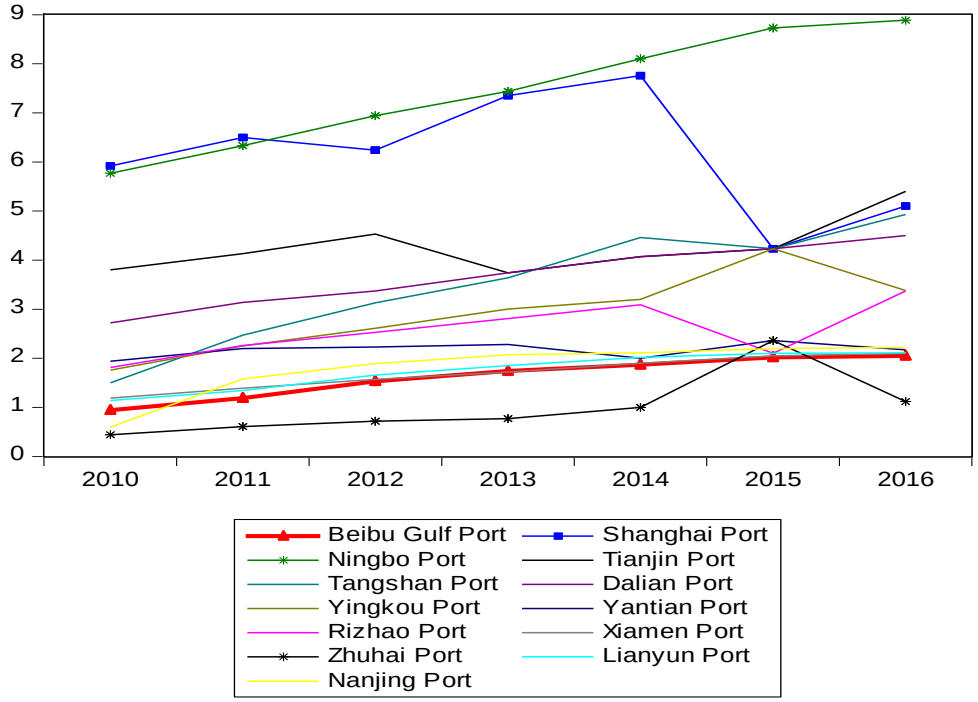

Figure 4-1 Changes in the throughput of coastal ports

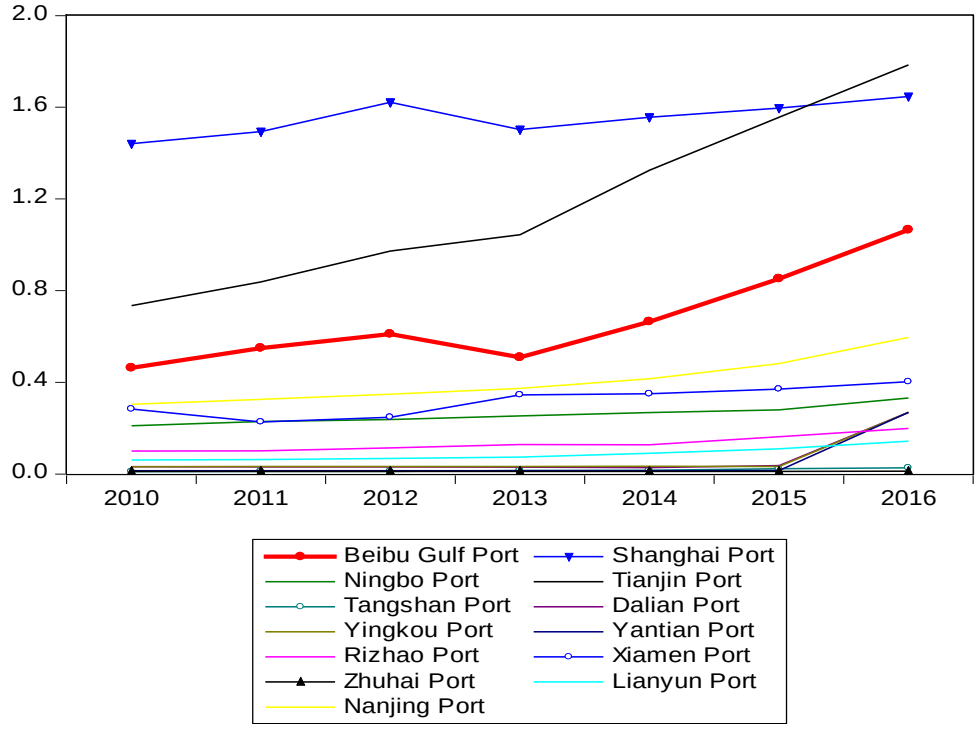

Figure 4-2 Connectivity conditions of coastal ports

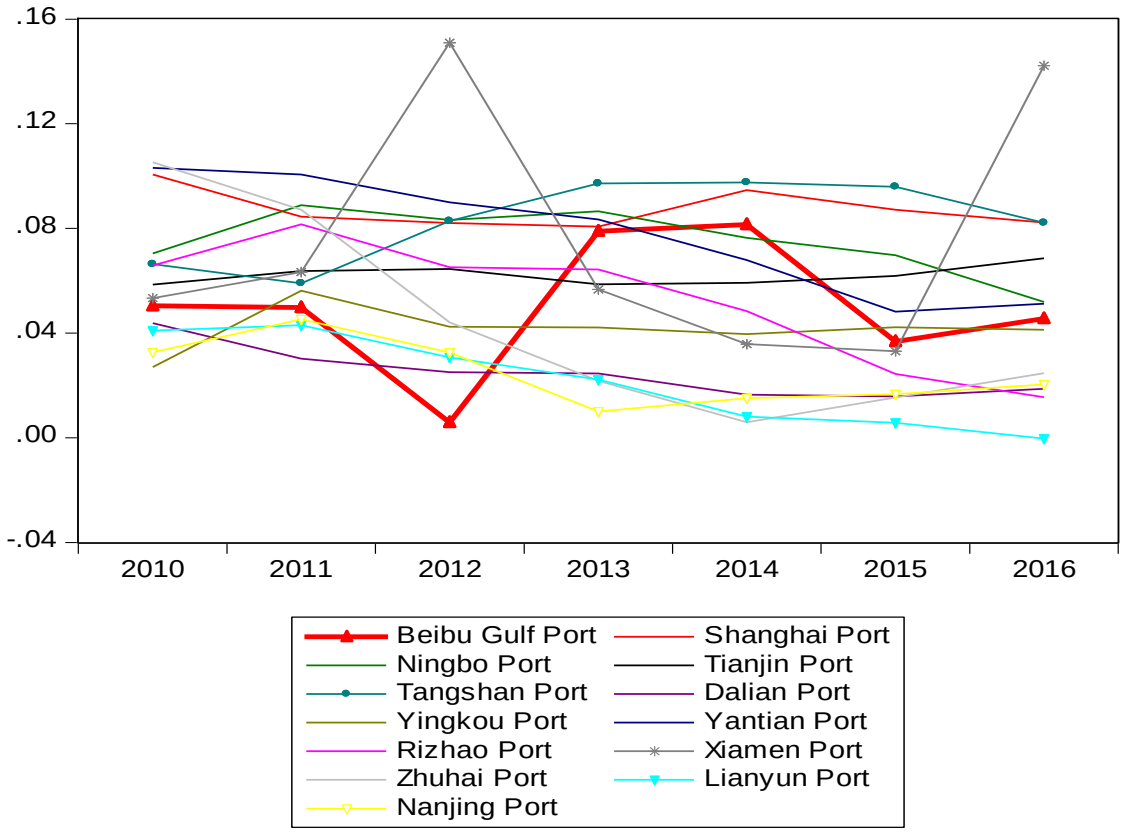

Figure 4-3 Operation efficiency of coastal ports

Figure 4-3 shows the operation efficiency of the 13 ports. The operation efficiency of the thirteen ports is distinctly different. The operation efficiency of the Beibu Gulf port during 2010~2016 years sometime is high and sometime is low, and there is no obvious change trend. It shows that the management level of the Beibu Gulf port is not stable and needs to be further optimized; the operation efficiency of Xiamen port is more unstable; the operation efficiency of Tangshan port is obvious upward trend and keeps high level. In the 13 ports, the operation efficiency of Nanjing port and Lianyun port are always relatively low.

The marketization index of the 13 ports increased significantly during 2010~2016(as shown in Figure 4-4). However, the marketization index of Beibu Gulf port and Tangshan port is the lowest, and the gap with the other 11 ports is obvious. The marketization index of Shanghai port, Nanjing port and Ningbo port has been kept at a high level.

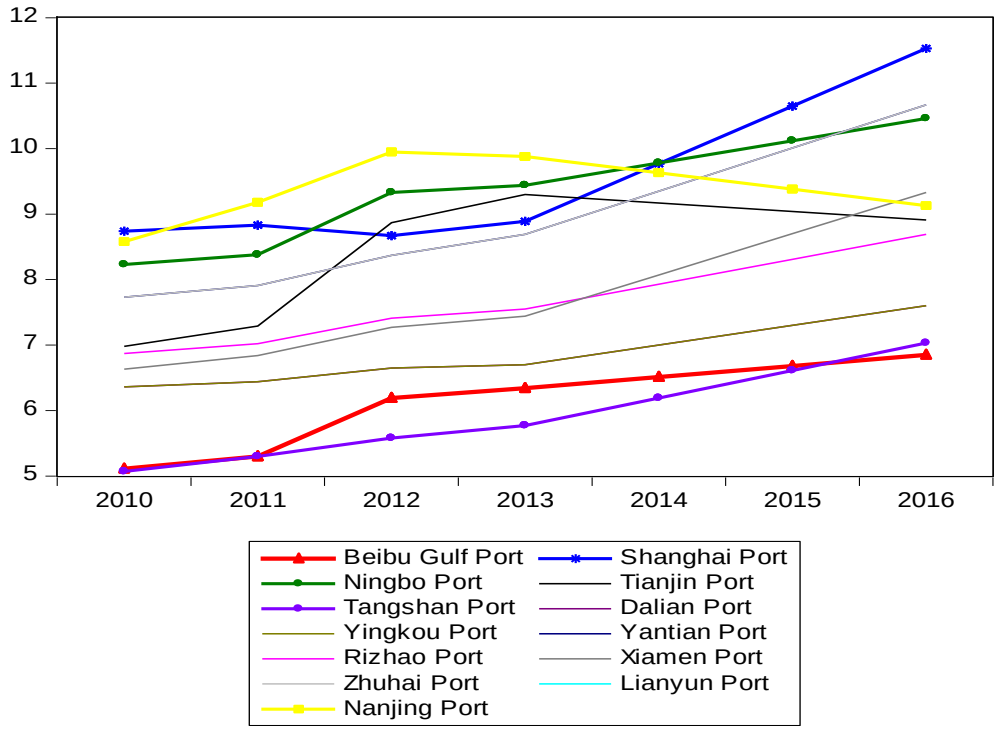

Figure 4-4 Changes in the institutional environment of coastal ports

4.6.3 Correlation coefficient matrix analysis

The correlation coefficient matrix of each variable is shown in table 4-3. It can be seen from the table that the length of wharf shoreline (Shoreline), the design channel passing capacity (Channel), the cost of port production and operation (Cost), port connectivity conditions (Route), operating efficiency (Efficiency) and the institutional environment (Institution) have a significant positive correlation with the port throughput. The port facility conditions include the length of wharf shoreline (Shoreline) and the port connectivity conditions (Company) have a significant negative correlation with the port competitiveness (Competitiveness). There is a certain difference between this and expectations. What is the relationship between variables? We need to analyze further and explore its internal causes.

Table 4-3 Correlation coefficient matrix

	Throughput	Competitiveness	Shoreline	Channel	Cost	Company	Efficiency	Institution
Throughput	1.0000							
Competitiveness	0.0057	1.0000						
Shoreline	0.8345***	-0.4726***	1.0000					

Channel	0.8214***	-0.1322	0.7794***	1.0000			
Cost	0.6932***	-0.0837	0.7101***	0.6599***	1.0000		
Company	0.4283***	-0.2233**	0.5922***	0.5924***	0.7838***	1.0000	
Efficiency	0.3013***	0.0818	0.2571**	0.3877***	0.2814**	0.2291**	1.0000
Institution	0.2629**	-0.1117	0.3269***	0.2716***	0.3133***	0.2852***	-0.0986	1.0000

4.7 Estimated results

4.7.1 The overall estimation of the theoretical model

The overall estimation of the theoretical model includes the following two parts: first, the hypothesis about mediating effect of port competitiveness between port resources and port throughput, which are proposed in the theoretical model, is going to be tested. It can provide a theoretical basis for the discussion of the formation of the port competitiveness of Beibu Gulf Port and it`s impact on the port throughput of Beibu Gulf Port. Second, the hypothesis about moderating effect of the institutional environment on the relationship between port resources and port competitiveness, which are proposed in the theoretical model, is going to be tested. This is a theoretical basis for discussing insititutional environment regulates the relationship between port resources and port competitiveness and the relationship between port ompetitiveness and port throughput in the Beibu Gulf port. The following are econometrics regression estimation of mediating effect and moderating effect in the theoretical model.

4.7.1.1Theoretical model estimations of mediating effect about the whole

The equations (4.1), equations (4.2) and equations (4.3) are used to test the mediating effect of port competitiveness between port resources and port throughput in the theoretical model. Referring to the method of Wen et al. (2005), first, the regression analysis of equation (4.1) is used to test the significance of the regression coefficient. If it is significant, the equation (4.2) and equation (4.3) can be further used to test if the mediating variable has the mediating effect. In this study, before the regression of the equation, the explanatory variables were centralized, and Eviews 7.0 software was used to conduct regression analysis of the collected panel data. Since this part is only the overall estimation of the theoretical model

proposed in the previous article, the individual effect and time effect of the port in the model are ignored, the panel data mixing effect model is used to regress. Table 4-4 shows the regression results of the mixing effect model of panel data.

It can be seen from Table 4-4 that, without considering the individual effect and time effect of the port, the regression coefficients of the model (1) are verified at the confidence level of 10%, all passed the significance test and the mediating effect of the port competitiveness can be further tested by equation (4.2) and equation (4.3).

Table 4-4 Mediating effect econometrics estimation results

Variable	Model(1)		Model(2)		Model(3)	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
C	3.094	0.000	0.445	0.000	3.118	0.000
Competitveness $_{it}$	—	—	—	—	3.188	0.000
Shoreline $_{it}$	0.003	0.085	0.0005	0.050	0.976	0.000
Channel $_{it}$	0.358	0.003	-0.166	0.000	0.106	0.003
Cost $_{it}$	0.619	0.000	0.122	0.006	0.002	0.168
Route$_{it}$	0.015	0.000	0.003	0.002	-0.737	0.000
Efficiency $_{it}$	-1.589	0.000	-0.212	0.081	-0.001	0.005
Adj R^2	0.848		0.487		0.962	

Note: The P value <0.01, <0.05, <0.1 and <0.2, indicates that the variable is significant at the level of of 1%, 5%, 10% and 20%.

By analyzing the regression results of equation (4.2) and equation (4.3), it is found that the adjusted R2 of regression equation (4.2) is 0.487 and the port resource regression coefficients passed the test of the confidence at the 10% confidence level; the adjusted R2 of the regression equation (4.3) is 0.962, the regression coefficient of port competitiveness to port throughput is 3.188 (p=0.000), and the regression coefficients of port resources for port throughput all passed the test at the confidence level of 5%. Therefore, in general, in the case of ignoring the individual effect and time effect of the port, the previous theoretical model verified that the hypothesis 9 that port resources can affect port throughput through port competitiveness. In other words, theoretically, the port competitiveness, as the mediating

variable of port resources and port throughput, has a mediating effect, which is in accordance with the results of Cho et al. (2015).

According to the method of Wen et al. (2005), the performance of the intermediary effect of port competitiveness on port resources and port throughput can be calculated by multiplying the regression coefficient of $Competitveness_{it}$ and the regression coefficients of specific measure index of port resources. From the results given in table 4-5, the mediating effect of port competitiveness on port facilities conditions and port throughput is -0.094 (=-0.209+0.112+0.003) on the whole, without considering the individual effect and time effect of port. The performance of the mediating effect of port competitiveness on the relationship between port connectivity conditions and port throughput is -0.206. The performance of the mediating effect of port competitiveness on the relationship between port operation efficiency and port throughput is 1.992.

Table 4-5 Mediating effect of port competitiveness on port resources and port throughput

index	Regression Coefficient of Each Port Resources Index (A) in Model (2)	Regression coefficient of Port Competitiveness (B) in Model (3)	Mediating effect (C=A*B)
$Shoreline_{it}$	-0.165	1.270	-0.209
$Channel_{it}$	0.088	1.270	0.112
$Cost_{it}$	0.003	1.270	0.003
$Route_{it}$	-0.162	1.270	-0.206
$Efficiency_{it}$	1.569	1.270	1.992

4.7.1.2The moderating effect estimation of theoretical model

The test of the moderating effect of institutional environment in the theoretical model can be divided into two aspects: the first is to examine the moderating effect of the institutional environment on the relationship between port resources and port competitiveness by analyzing the regression of equations (4.4) and (4.5) constructed in the previous article; the second is to test the moderating effect of the institutional environment on the relationship between port competitiveness and port throughput by analyzing the regression of equations (4.6) and (4.7).

This part aims to estimate the overall effect of the theoretical model, so the individual

effect and time effect of the port in the model are ignored. The panel data mixing effect model was used to regress the theoretical model of moderating effect on the relationship between port resources and port competitiveness. Table 4-6 is econometrics test results of institutional environment`s moderating effect on relationship of port resources and port competitiveness. Table 4-7 is econometrics test results of institutional environment`s moderating effect on relationship of port competitiveness and port throughput.

Table 4-6 Econometrics test results of institutional environment's moderating effect on relationship of port resources and port competitiveness

	Model (4)		Model (5.1)		Model (5.2)	
Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Shoreline $_{it}$	-0.130	0.000	-0.319	0.002	-0.278	0.000
Channel $_{it}$	0.064	0.002	0.089	0.582	—	—
Cost $_{it}$	0.002	0.002	0.013	0.000	0.013	0.000
Route$_{it}$	-0.264	0.000	-0.628	0.028	-0.697	0.010
Efficiency $_{it}$	2.950	0.000	10.085	0.025	11.734	0.000
Institution $_{it}$	0.082	0.000	0.091	0.000	0.091	0.000
Shoreline $_{it}$*Institution $_{it}$	—	—	0.021	0.063	0.016	0.059
Channel$_{it}$*Institution $_{it}$	—	—	-0.004	0.838	0.007	0.047
Cost$_{it}$*Institution $_{it}$	—	—	-0.001	0.000	-0.001	0.000
Route$_{it}$*Institution $_{it}$	—	—	0.061	0.088	0.068	0.049
Efficiency $_{it}$*Institution $_{it}$	—	—	-0.993	0.087	-1.184	0.003
Adj R^2	0.909		0.700		0.703	

Note: P value <0.01, <0.05, <0.1, indicates the variable is significant at the level of 1%, 5% and 10%.

Table 4-6 shows that all the undependent variables in the model (4) have passed the test at the confidence level of 1%, and the adjusted R^2 is 0.909. Model (5.1) regression coefficient of the length of wharf shoreline to port competitiveness, the length of wharf shoreline and institutional environment of the model (5.1) to port competitiveness is not significant. After the length of wharf shoreline is deleted, all the undependent variables in the model (5.2) passed the test at the confidence level of 10%, and the adjusted R^2 is 0.703. Therefore, given

the individual effect and time effect of the port in the model be ignored, the moderating effect of institutional environment on the relationship between port resources and port competitiveness is existing which provides a basis for further discussion of the moderating effect of different port institutional environment. It can be seen from the interaction terms of the independent variables that the moderating effect of the institutional environment on the relationship between the specific indicators of port resources and the ports competitiveness can be positive or negative, and the size are different.

Table 4-7 is the moderating effect of the institutional environment on the relationship between port competitiveness and port throughput. It shows that each independent variables in the model (6) has passed the test at the confidence level of 1%, and all independent variables in the regression results of model (7) have passed the test at the level of 1%. Therefore, It does exist the moderating effect of institutional environment on the relationship between port competitiveness and port throughput with ignoring the individual effect and time effect of the model.

Then, the following model (11) will be used to explore the moderating effect of the institutional environment on the relationship between port competitiveness and port throughput of the Beibu Gulf port. The symbol of the interaction coefficient of the institutional environment and the port competitiveness is negative which indicates that the imperfect environment of the whole system has weakened the promotion of port competitiveness to the port throughput.

Table 4-7 Econometrics test results of institutional environment's moderating effect on relationship of port competitiveness and port throughput

	model(6)		model(7)	
Variable	Coefficient	Prob.	Coefficient	Prob.
Competitveness $_{it}$	2.213	0.000	6.976	0.000
Institution $_{it}$	0.412	0.000	0.757	0.000
Competitvenessit*Institution $_{it}$	—		-0.852	0.000
Adj R^2	0.907		0.692	

Note: P value is <0.01, <0.05, <0.1, indicates the variable is significant at the level of 1%, 5% and 10%.

4.7.2 Estimated results of relationship between port resources and port competitiveness of Beibu Gulf Port

In order to test the relationship between port resources and port competitiveness of Beibu Gulf port, base on equation (4.8) constructed above, quantitative regression analysis was conducted useing panel data. Table 4-8 is the estimation result of the cross-section individual variable coefficient model about impact of port resources on port competitiveness. According to the results, the regression coefficients of each port resources variables are different which means that the impacts of the port resources on the port competitiveness are different. This study will focus on several variables.

4.7.2.1Estimated results of relationship between port facility conditions and port competitiveness

In the Beibu Gulf port facilities conditions, the regression coefficient of the length of wharf shoreline to port competitiveness is positive (0.107). The regression coefficient of port channal passing capacity and the cost of port production and operation to the port competitiveness is negative (-0.063 and -0.001). It means that, at present, some facilities of Beibu Gulf port can play a positive role; some facilities are not good enough to promote the port competitiveness of Beibu Gulf. However, the sum of the regression coefficients of the three indexes is 0.043. It shows that the port facilities conditions have promoted the competitiveness of the Beibu Gulf port under this conditions.Which proves that the hypothesis 1 is supported. That means the port facilities and the port competitiveness are positively related.

4.7.2.2Estimation results of port connectivity conditions and port competitiveness

The regression coefficient of port connectivity condition to the competitiveness of Beibu Gulf port is -0.0001, and the P value is 0.998. It does not pass the significance test. It shows that the port competitiveness of the Beibu Gulf port has no significant promoting function on the port competitiveness. Therefore, the research results do not support the hypothesis 2 -- the port connection conditions are positively related to the port competitiveness.

4.7.2.3Estimation results of relationship between port operation efficiency and port competitiveness

The regression coefficient of port operation efficiency to port competitiveness of Beibu Gulf port is 0.622 which is significant at the confidence level of 1%. It shows that the port operation efficiency of Beibu Gulf port plays a positive role in promoting its port competitiveness. Therefore, the hypothesis 3 is proved that means there is a positive relationship between port operation efficiency and port competitiveness.

Table 4-8 Estimation result of the cross-section individual variable coefficient model about the impact of port resources on port competitiveness

	Facility it						Route $_{it}$		Efficiency $_{it}$	
	Shoreline $_{it}$		Channel $_{it}$		Cost $_{it}$					
	coefficient	P	coefficient	P	coefficient	P	coefficient	P	coefficient	P
Beibu Gulf Port	0.107	0.000	-0.063	0.061	-0.001	0.000	-0.0001	0.998	0.622	0.000
Shanghai Port	0.293	0.086	-0.270	0.153	0.001	0.395	-0.425	0.281	0.696	0.800
Ningbo Port	0.106	0.470	-0.014	0.300	-0.001	0.346	-0.709	0.798	-1.288	0.796
Tianjin Port	-0.259	0.012	-0.008	0.641	0.001	0.181	-0.008	0.916	26.500	0.000
Tangshan Port	-0.632	0.263	-0.055	0.805	0.047	0.001	-19.181	0.571	12.746	0.000
Dalian Port	0.180	0.000	-0.069	0.041	0.000	0.036	-0.099	0.044	0.952	0.060
Yingkou Port	1.445	0.084	-1.837	0.004	0.030	0.481	-3.178	0.009	13.204	0.010
Yantian Port	1.543	0.000	-0.008	0.589	0.029	0.355	-0.792	0.000	0.062	0.733
Rizhao Port	-0.337	0.763	-0.093	0.231	0.001	0.913	6.737	0.322	11.001	0.144
Xiamen Port	0.002	0.984	0.077	0.459	-0.004	0.027	1.537	0.038	0.294	0.075
Zhuhai Port	-0.527	0.581	0.150	0.247	0.017	0.660	58.668	0.505	0.757	0.581
Lianyun Port	-0.023	0.919	-0.013	0.916	0.064	0.000	0.566	0.802	-1.116	0.516
Nanjing Port	-0.194	0.002	-0.029	0.696	0.273	0.069	1.151	0.002	1.521	0.434

Note: (1) Adjusted R^2=0.998.

(2) P value <0.01, <0.05, <0.1, indicates the variable is significant at 1%, 5% and 10% levels.

4.7.3 Estimation results of the Beibu Gulf Port's institutional environment moderating the relationship between port resources and port competitiveness

In order to explore the moderating role of institutional environment on port resources and port competitiveness, a regression equation (4.10) was constructed to empirically analyze the institutional environment moderating direction (positive or negative) and strength on the relationship between port resources and port competitiveness in Beibu Gulf Port. Table 4-9 is estimation result of the cross-section individual variable coefficient model about institutional environment moderating the relationship of port resources and port competitiveness. The upper part of Table 4-9 is the estimated result of the model (10) under the same cross-section individual variable coefficient. The lower part of the table is the estimation of the interaction term coefficient of port resource related variables and the institutional environment of the ports. Specific analysis is as follows:

4.7.3.1Estimation of institutional environment moderating the relationship between port facilities conditions and port competitiveness in Beibu Gulf Port

It can be seen from Table 4-9 that, to the Beibu Gulf port, the interaction term regression coefficient of the length of wharf shoreline and the institutional environment to the port competitiveness passed the significance test but the value is negative(β=-0.079 ， p=0.00 <0.01). The interaction term regression coefficient of channel passing capability and the institutional environment to the port competitiveness passed the significant test(β=0.075, p=0.002 <0.01). The interaction term regression coefficient of the port production and operation cost and the institutional environment is tested but the correlation coefficient is negative (β=-0.001, p=0.02 <0.05). The results shows that the institutional environment of the Beibu Gulf port have positive promotion on the relationship between the length of wharf shoreline and the port competitiveness and negative inhibition on the relationship between the channel passing capability and the port competitiveness. The sum of the interaction term regression coefficients of three indicators of port facilities conditions and the institutional environment is -0.005. Which indicats that, in general, under the moderating effect of the institutional environment on the relationship between port facilities conditions and the competitiveness of the Beibu Gulf port, some port facilities can play a positive role in

promoting. Some port facilities are not good enough to play a positive role in promoting the competitiveness of the Beibu Gulf port. At present, the institutional environment of the Beibu Gulf port is playing a role in moderating the relationship between the port facilities conditions and the port competitiveness. However it not plays a positive role in promoting, but a negative inhibitory role. So, hypothesis 4 that the institutional environment of Beibu Gulf port positively moderats the relationship between port facilities and port competitiveness is not supported.

4.7.3.2Estimation of the institutional environment of Beibu Gulf Port moderating the relationship between port connectivity conditions and port competitiveness

The interaction term regression coefficents of the institutional environment of the Beibu Gulf port and the port connectivity conditions is verified (β=0.082, p=0.031 ＜0.05) at the significance level of 5% and the regression coefficient is positive. It reflects that the institutional environment of the Beibu Gulf port plays a positive role in moderating the relationship between port connectivity conditions and port competitiveness. So, Hypothesis 5 that the institutional environment of Beibu Gulf port positively moderates the relationship between port connectivity conditions and port competitiveness is supported.

4.7.3.3Estimation of institutional environment moderating the relationship between port operation efficiency and port competitiveness in Beibu Gulf Port

The interaction term regression coefficents of the institutional environment of the Beibu Gulf port and the operation efficiency of port passed the significence test but the regression coefficient is negative (β=-0.673, p=0.00＜0.01). It shows that the present institutional environment of the Beibu Gulf port in Guangxi does not play a positive role in moderating the relationship between port operation efficiency and port competitiveness. The hypothesis 6, the institutional environment play a positive role in moderating the relationship between port operation efficiency and port competitiveness proposed in the previous article, is not supported.

Table 4-9 Estimation result of the cross-section individual variable coefficient model about institutional environment moderating the relationship of port resources and port competitiveness

The	Competitveness $_{it}$= -0.155Shoreline $_{it}$+0.201Channel $_{it}$+0.007Cost $_{it}$

The estimation results of the front half of the model

(0.003) (0.000) (0.000)

$-0.699Route_{it} + 5.934Efficiency_{it} + 0.164Institution_{it}$

(0.000) (0.000) (0.000)

The estimation results of the latter half of the model

Cross-Section	$Facility_{it}$*$Institution_{it}$						$Route_{it}$ *$Institution_{it}$		$Efficiency_{it}$ *$Institution_{it}$	
	$Shoreline_{it}$ *$Institution_{it}$		$Channel_{it}$ *$Institution_{it}$		$Cost_{it}$ *$Institution_{it}$					
	coefficient	p	coefficient	p	coefficient	p	coefficient	p	coefficient	p
Beibu Gulf Port	-0.079	0.000	0.075	0.002	-0.001	0.020	0.082	0.031	-0.673	0.000
Shanghai Port	-0.043	0.005	0.024	0.099	-0.001	0.000	0.170	0.000	-0.750	0.000
Ningbo Port	0.000	0.697	-0.021	0.000	-0.001	0.000	0.125	0.044	-0.843	0.000
Tianjin Port	-0.069	0.000	-0.025	0.000	-0.001	0.000	0.112	0.000	2.183	0.000
Tangshan Port	0.072	0.004	-0.047	0.000	0.003	0.000	-9.267	0.000	-1.684	0.000
Dalian Port	0.029	0.004	-0.086	0.000	-0.001	0.007	0.039	0.334	-0.491	0.137
Yingkou Port	0.107	0.000	-0.092	0.000	-0.003	0.000	-0.127	0.000	-0.607	0.000
Yantian Port	-0.080	0.000	-0.021	0.000	-0.003	0.204	0.104	0.000	-0.550	0.000
Rizhao Port	-0.200	0.005	-0.043	0.000	0.000	0.572	1.114	0.005	0.599	0.144
Xiamen Port	-0.030	0.000	-0.058	0.000	0.000	0.073	0.162	0.000	-0.653	0.000
Zhuhai Port	-0.008	0.883	0.009	0.283	-0.001	0.773	-11.278	0.040	-0.724	0.000
Lianyun Port	-0.066	0.000	-0.003	0.676	-0.001	0.118	0.368	0.001	-1.159	0.000
Nanjing Port	-0.064	0.000	-0.018	0.001	0.033	0.000	0.213	0.000	-0.698	0.000

Note: (1) Adjusted R^2=0.995.

(2) In the estimated result of the first half of the model, the value in brackets is P statistic of the independent variable.

(3) P <0.01, <0.05, <0.1, indicates the variable is significant at the level of 1%, 5% and 10%.

4.7.4 Estimates of relationship between port competitiveness and port throughput of Beibu Gulf Port

Base on the cross-section individual variable coefficient model about impact of port competitiveness on port throughput, the estimation results in Table 4-10 are obtained by regression of panel data. At the 10% significant level, the regression coefficient of the Beibu Gulf port competitiveness ($Competitveness_{it}$) and the Beibu Gulf port throughput ($Throughput_{it}$) is 7.618 ($p=0.00 <0.1$) indicating that the competitiveness of the Beibu Gulf Port has a positive effect on the port throughput. The stronger the competitiveness of the Beibu Gulf port is, the greater the port's throughput is. Hypothesis 7 is supported.

Table 4-10 Estimation result of the cross-section individual variable coefficient model about port competitiveness' impact on port throughput

	Coefficient	Std. Error	t-Statistic	Prob.
Beibu Gulf Port	7.618	0.638	11.944	0.000
Shanghai Port	14.508	0.768	18.880	0.000
Ningbo Port	18.367	1.120	16.400	0.000
Tianjin Port	5.005	0.267	18.759	0.000
Tangshan Port	3.799	0.627	6.055	0.000
Dalian Port	8.009	0.487	16.454	0.000
Yingkou Port	3.156	0.346	9.124	0.000
Yantian Port	2.169	0.057	38.323	0.000
Rizhao Port	2.650	0.202	13.144	0.000
Xiamen Port	3.855	0.313	12.332	0.000
Zhuhai Port	4.240	0.285	14.871	0.000
Lianyun Port	2.011	0.150	13.437	0.000
Nanjing Port	5.732	0.941	6.094	0.000

Note：(1) P value <0.01, <0.05, <0.1, indicates t the variable is significant at 1%, 5% and 10% levels.

(2)The Adjusted R^2 of the model is equal to 0.889.

At the same time, compared with the port which has significant relationship between competitiveness and throughput, Shanghai port, Ningbo port and Dalian port have higher

elasticity coefficient. In certain extent, the promoting function of competitiveness of the Beibu Gulf port on its throughput is not sufficent.

4.7.5 Estimation results of the Beibu Gulf Port`s institutional environment moderating the relationship between port competitiveness and port throughput

The estimation of the empirical equation (4.11) given in table 4-11 shows that the interaction term regression coefficents of the institutional environment of the Beibu Gulf port and the port competitiveness passed the significence test and the value is positive (β=3.28, p=0.008＜0.1). It indicated that the current institutional environment of the Beibu Gulf port plays a positive role on moderating the relationship between port competitiveness and port throughput. The hypothesis 8, the institutional environment of Beibu Gulf port plays a positive role on moderating the relationship between port competitiveness and port throughput, is supported. It means that, according to the previous empirical conclusions, if the facilities conditions of the Beibu Gulf port can be constantly improved, the relationship between the connectivity conditions of the Beibu Gulf port and the port competitiveness can be adjusted correctly, the relationship between the operation efficiency of the Beibu Gulf Port and the port competitiveness is properly handled, the competitiveness of the Beibu Gulf port will be improved. By continuous improvement and utilization of the institutional environment of the Beibu Gulf port might to increase the throughput of the Beibu Gulf port. At the same time, by comparing with other ports, it is found that the correlation coefficient of the interaction term of the Beibu Gulf port institutional environment and the port competitiveness is less than that of the large ports like Ningbo and Dalian Port. It shows that the moderating effect of the institutional environment of the Beibu Gulf port is relatively small, and the institutional environment of the Beibu Gulf port need to be further improved in the future. More institutional dividends should be explored to promote the healthy development of port competitiveness and port throughput in the Beibu Gulf port.

Table 4-11 Estimation result of the cross-section individual variable coefficient model about institutional environment moderating the relationship of port competitiveness and port throughput

The estimation results of the front half of the	$Throughput_{it}$= -9.53$Competitveness_{it}$ -0.492$Institution_{it}$ (0.006) (0.073)

model

$Competitveness_{it}$*$Institution_{it}$

The estimation results of the latter half of the model	Cross-Section	BeibuGulf Port	Shanghai Port	Ningbo Port	Tianjin Port	Tangshan Port	Dalian Port	Yingkou Port	Yantian Port	Rizhao Port	Xiamen Port	Zhuhai Port	Lianyun Port	Nanjing Port
	coefficient	3.280	1.129	3.878	1.198	2.060	3.505	2.107	0.536	1.551	1.628	1.627	1.027	1.328
	P	0.008	0.111	0.000	0.003	0.001	0.005	0.013	0.168	0.000	0.023	0.001	0.016	0.002

Note: (1) Adj R^2=0.915.

(2) In the estimated result of the first half of the model, the value in brackets is P statistic of the independent variable.

(3)If P <0.01, <0.05, <0.1, <0.15, this variable is significant at the level of 1%, 5%, 10% and 15%.

4.7.6 Regression result about the competitiveness of Beibu Gulf Port is the mediating variables of the relationship between port resources and port throughput

Refering to Wen, et al (2005) method, with the collected panel data, in order to prove that the port competitiveness of Beibu Gulf Port is an mediating variable between port resources and port throughput, first, by regressing the cross-sectional individual variable coefficient of equation (4.1) constructed above, we will test whether the regression coefficient of port resources of Beibu Gulf Port resources to port throughput is significant. If the regression coefficient is significant, then the equation (4.2) and equation (4.3) will be regressed by cross-sectional individual variable coefficients in turn. By observing whether the variable of Beibu Gulf port competitiveness is significant in these models, we can test whether the Beibu Gulf port competitiveness can be used as a mediating variable. In table 4-12, the regression results about the impact of Beibu Gulf port resources on port throughput which in equation (4.1) are listed in Model (1-1); the regression results about the impact of Beibu Gulf port competitiveness on port resources which in equation (4.2) are listed in Model (2-1); the regression results about the impact of competitiveness and port resources on port throughput which in equation (4.3) are listed in Model (3-1).

From Table 4-12, we can see that, in model(1-1)the regression results of the impact of Beibu Gulf port resources on port throughput, the port infrastructure index, port connectivity condition index and port operation efficiency index have passed the significance test.

Therefore, we can further use equation (4.2) and equation (4.3) to test whether Beibu Gulf port competitiveness can be used as a mediating variable.

Table 4-12 Regression results for testing the mediating effect of Beibu Gulf port competitiveness

Variable	Model(1-1)		Model(2-1)		Model(3-1)	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
$Shoreline_{BBGP}$	0.831	0.000	0.107	0.000	-1.378	0.008
$Channel_{BBGP}$	-0.740	0.008	-0.063	0.061	1.493	0.000
$Cost_{BBGP}$	-0.020	0.000	-0.001	0.000	0.031	0.001
$Route_{BBGP}$	-2.978	0.000	0.0001	0.998	0.079	0.884
$Efficiency_{BBGP}$	-10.235	0.000	0.622	0.000	-6.873	0.005
$Competitveness_{BBW}$	--	--	--	--	13.260	0.008
Adj R^2	0.993		0.998		0.985	

Note: If P<0.01, <0.05, <0.1 indicates that the variable is significant at the level of 1%, 5% and 10%.

In Table 4-12, according to the regression result of model (2-1) about the impact of Beibu Gulf port competitiveness on port resources, the index of port connectivity conditions for measuring Beibu Gulf port resources has not passed the significance test, and the other two indexes of port infrastructure and port operation efficiency have passed the significance test. From the regression result model (3-1) about the impact of Beibu Gulf port competitiveness and port resources on port throughput, it can be seen that, except the port connectivity condition which is one of the indexes of Beibu Gulf port resources did not pass the significance test, the other indexes of Beibu Gulf port resources passed the significance test. The impact of port competitiveness on port throughput also passed the significance test.

Therefore, from the regression results of the mediating effect of the Beibu Gulf port competitiveness on the relationship between port resources and port throughput, it is found that not all the Beibu Gulf port resources significantly affect the port competitiveness, while the Beibu Gulf port competitiveness significantly affects the port throughput. So overall, although there are individual variables did not pass the significance test, there is mediating effect in all. That is, the Beibu Gulf port resources have impact on the port throughput through the port competitiveness. Hypothesis 9 is supported.

4.7.7 Econometrics regression results summary

Based on the above analysis of the collected macroscopic second-hand data, we verified that some hypotheses are supported and some hypotheses are not supported (see Table 4-13). The supported hypotheses are as follows: the port facility conditions are positively correlated with the port competitiveness of Beibu Gulf port (Hypothesis 1); The port operation efficiency is positively correlated with the port competitiveness of Beibu Gulf port (Hypothesis 3); The influence degree of institutional environment positively moderats the relationship between port connectivity conditions and port competitiveness (Hypothesis 5). Port competitiveness is positively correlated with Beibu Gulf port throughput (Hypothesis 7); the influence degree of institutional environment positively moderats the relationship between port competitiveness and port throughput (Hypothesis 8). The port competitiveness of Beibu Gulf is a mediator variable between port resources and port throughput (Hypothesis 9). The following three hypotheses are not supported: port connectivity conditions are positively correlated with Beibu Gulf port competitiveness (Hypothesis 2); the influence degree of institutional environment positively moderats the relationship between port facilities conditions and port competitiveness (Hypothesis 4). The influence degree of institutional environment positively moderates the relationship between the port operation efficiency and port competitiveness (Hypothesis 6).

In order to further verify and explain the analysis results of the port competitiveness study of Beibu Gulf port in guangxi based on the above second-hand statistical data, the survey by questionnaires was conducted to the employees of Beibu Gulf port operators. The following is a statistical analysis of the collected microcosmic first-hand data.

Table 4-13 Hypotheses and the test conclusion

Order number	Hypothesis	Test result	Result
1	Port Facility Conditions are Positively Correlated to the Competitiveness of Beibu Gulf Port.	The regression coefficients of the port shoreline length, the port designed throughput capacity and the cost of port production and operation to the port competitiveness of Beibu Gulf Port have passed the significance test, and the sum of the regression coefficients of the three indexes is	supported

		0.043.	
2	Port Connectivty Conditions are Positively Correlated to the Competitiveness of Beibu Gulf Port.	The regression coefficient of port port connectivity to the port competitiveness of Beibu Gulf port has not passed the significance test.	not supported
3	Port operation efficiency is Positively Correlated to the Competitiveness of Beibu Gulf Port.	The regression coefficient of port operation efficiency to the port competitiveness of Beibu Gulf passed the significance test by a size of 0.622.	supported
4	The positive relationship between port facilities conditions and port competitiveness will be stronger when there is a favorable institutional environment.	The regression coefficients of the three interaction term indexes about the Beibu Gulf port facilities conditions: the port shoreline length and the institutional environment, the port designed throughput capacity and the institutional environment, and the cost of port production and operation and the institutional environment, have passed the significance test, but the sum of the regression coefficients of the three indexes is - 0.005.	not supported
5	The positive relationship between port connectivity conditions and port competitiveness will be stronger when there is a favorable institutional environment.	The interaction term of the institutional environment and the connectivity conditions of of the Beibu Gulf port passed the significance test and the regression coefficient is 0.082.	supported
6	The positive relationship between port operation efficiency and port competitiveness will be stronger when there is a favorable institutional environment.	The interaction term of the institutional environment and the connectivity conditions of of Beibu Gulf port has passed the significance test, but the regression coefficient is - 0.673.	not supported
7	Port competitiveness is positively correlated to port throughput in Beibu Gulf.	The regression coefficient of port competitiveness to port throughout of the Beibu Gulf port passed the significance test. The regression coefficient is 7.618.	supported
8	The positive relationship between port competitiveness and port throughput will be stronger	The regression coefficient of interaction term of port competitiveness and the institutional environment passed the significance test. The	supported

	when there is a favorable institutional environment.	regression coefficient is 3.28.	
9	Port competitiveness positively mediates the relationship between port resources and port throughput.	All indexes of Beibu Gulf port resources passed the significance test except the regression coefficient of port connectivity condition to port competitiveness. At the same time, the regression coefficient of Beibu Gulf port competitiveness to port throughput passed the significance test.	supported

4.8 Questionnaire analysis

According to the analysis of the conclusion above, questionnaire surveys are conducted on employees of the relevant operation units of Qinzhou port, Beihai port and Fangcheng port which are sub-ports covered by Beibu Gulf port (questionnaire are attached in appendix I). The main purpose of questionnaire investigation is to extract relevant information to explain the results of above quantitative analysis from the answers of the employees of different positions and different service years which includes: (1) the competitive advantages and disadvantages of Beibu Gulf port and its main competitors; (2) the internal and external institutional environment of Beibu Gulf port and its role in port competitiveness; (3) the port resources situation of Beibu Gulf port and its relationship with the port competitiveness.

Questionnaire is composed of two parts, one part is the investigation of the influence of various factors on the Beibu Gulf port competitiveness, and this is for further explaining about the regression results of macro second-hand data. Another part is investigation about the relationship between port resources, institutional environment and port competitiveness in Beibu Gulf port, mainly is to investigate opinions of staffs, who have various posts and various service years, about whether port resources is positively correlated with port competitiveness; whether port competitiveness is positively correlated with port throughput; whether the institutional environment plays a positive role in regulating the relationship between port resources and port competitiveness and whether the institutional environment plays a positive role in regulating the relationship between port competitiveness and port throughput.

In order to maintain the consistency of the research ideas, the following part will analyze the survey data on the relationship between port resources, institutional environment and port competitiveness of Beibu Gulf port. The basic views of port practitioners on the hypotheses proposed in this study are summarized. The first-hand data and data obtained from the questionnaire survey will be used to explain the results of econometrics regression and questionnaire survey in the next chapter.

4.8.1 Participants and procedure

From May 2018 to June 2018, in Beihai port, Qinzhou port and Fangcheng port, one hundred and twenty (120) questionnaires was given out in which the number of people who take part in questionnaire survey are 30 from the Beihai port, 60 from the Qinzhou port, 30 from Fangcheng port. In which 91 questionnaires collected are valid and can be used to analyze. According to the post classification of respondents (see Table 4-14), Front-line managers is the most who account for 69.2% of the total, the grassroots managers account for 15.4% of the total. There are 91 respondents in which 2 senior managers and 7 middle managers account for 7.7% and 2.2% of the total separately.

Table 4-14 Questionnaire distribution by post

		Frequency	Percentage	valid Percentage	Cumulative Percentage
Valid	Front-line managers	63	69.2	69.2	69.2
	Grassroots managers	14	15.4	15.4	84.6
	Middle Managers	7	7.7	7.7	92.3
	Senior Manager	2	2.2	2.2	94.5
	Missing Value	5	5.5	5.5	100
	Total	91	100.0	100.0	

According to the service years of the respondents who are engaged in seaport-related work (see Table 4-15), among the 83 employees who have been counted, the longest service years are 30 years, the shortest service years are 1 year, and the average service years are 6.71 years. In addition, According to the frequency distribution table of service years (see Table 4-15), it can be seen that among the respondents, 56% of the employees have worked for less

than 5 years, and 86.7% have worked for less than 15 years.

Table 4-15 Service years frequency distribution of respondents (Port related)

	Group	Frequency	Percentage	Valid Percentage	Cumulative Percentage
	1-5	51	56.0	61.4	61.4
	10-15	18	19.8	21.7	83.1
	15-20	5	5.5	6.0	89.2
Valid	21-25	5	5.5	6.0	95.2
	26-30	1	1.1	1.2	96.4
	6-10	3	3.3	3.6	100.0
	Total	83	91.2	100.0	
Missing	System	8	8.8		
Total		91	100.0		

4.8.2 Survey results of questionnaires

According to the data collected from the questionnaire survey, we further analyze the results of the previous econometrics regression analysis.

4.8.2.1Survey results of relationship between port resources and port competitiveness in Beibu Gulf Port

Regarding the relationship between Beibu Gulf port resources and port competitiveness, our previous econometric regression results show that, in Beibu Gulf port resources, the port facilities conditions are positively related to the port competitiveness; the port connectivity conditions are not significantly related to the port competitiveness; the port operation efficiency is positively related to port competitiveness in Beibu Gulf. Correspondingly, according to the actual situation of Beibu Gulf Port, the respondents were asked to discuss the relationship among port facilities conditions, port connectivity conditions, port operation efficiency and port competitiveness. The survey results were obtained in table 4-16 after data analysis. The results show that 50 respondents (55%) believe that there is a positive correlation between port facilities conditions and port competitiveness, and there is also a positive correlation between port operation efficiency and port competitiveness, while only 39

(43%) respondents believe that the port connectivity conditions and the competitiveness of Beibu Gulf port are positively related or mutual promoted.

Therefore, we can basically confirm that most respondents agree that there is a positive correlation between port facilities conditions and port competitiveness, and there is a positive correlation between port operation efficiency and port competitiveness, which is consistent with the conclusion of the previous econometric regression. However, about the relationship between the port connectivity conditions and the Beibu Gulf port competitiveness, less than half of the data were answered positively while more than half respondents are not cerntain that there is a positive relationship between port connectivity conditions and port competitiveness. Such result aligns with the econometric regression result.Therefore, the conclusion that there is no significant correlation between the port connectivity conditions and the Beibu Gulf port competitiveness is further confirmed.

Table 4-16 Survey results on relationship between port resources and port competitiveness

	Relationship between port facilities conditions and port competitiveness	Relationship between port connectivity conditions and port competitiveness	Relationship between port operation efficiency and port competitiveness
Positive correlation	50	39	50
Negative correlation	0	0	0
Unrelated	0	0	0
Uncertain	41	52	41
Total number of respondents	91	91	91

4.8.2.2Survey results of institutional environment impact on port competitiveness in the Beibu Gulf Port

During the survey, respondents are asked "which support or preferential policies did the state and guangxi autonomous region have respectively promoted the development of Beibu Gulf port?"After sorting out the answers of the respondents, it is found that, in Table 4-17, front-line managers and grass-roots managers most agree with the development policy of "Opening-up of Seashore, River Shore and Border Areas" initiative policies play a role of

promoting the development of Beibu Gulf port, but senior managers believe that container shipping policy play a role of promoting the development of Beibu Gulf port is more obvious. Through an in-depth survey, respondents believe that most of the policies can not directly promote the development of Beibu Gulf Port, but through influencing other factors to promote the development of Beibu Gulf Port, so the institutional environment is only a moderator most of the time. The results of the questionnaire are consistent with the theoretical analysis.

Table 4-17 Survey results of which supportive or preferential policies promoted the development of Beibu Gulf port by post division

			Support or Preferential Policies Promotes of Beibu Gulf Port				Total
			"Opening-up of Seashore, River Shore and Border Areas" initiative policies	Fiscal and Tax Policy	Container Shipping Policy	Special Policy for the Revitalization of Logistics	
Post	Front-line managers	Frequency	22	13	6	2	43
	Grassroots managers	Frequency	4	4	2	2	12
	Middle Managers	Frequency	3	4	0	0	7
	Senior Manager	Frequency	0	0	1	0	1
	Total	Frequency	29	21	9	4	

Note: the respondents have different views on the question, and the number of responses after data reduction is not exactly equal to the number of collected questionnaires.

As to whether the institutional environment of Beibu Gulf Port can positively moderate the relationship between port resources and port competitiveness, we can find from Table 4-18. There are 68.23% respondents think that the institutional environment positively moderates the relationship between port facilities condition and the port competitiveness. However, we also notice that 25.88% of the respondents agreed partially with the hypothesis that the institutional environment positively moderating the relationship between port facilities and port competitiveness in the Beibu Gulf, 4.71% of the respondents clearly disagreed, and 1.18% of the respondents disagreed partially.

There are 75.29% respondents think that the institutional environment positively moderates the relationship between the port operation efficiency and the port competitiveness. Another 21.18% of the respondents agreed partially, 3.53% of the respondents disagreed and 1.18% of the respondents disagreed partially.

Table 4-18 Survey results of institutional environment moderates the relationship between port resources and port competitiveness, and the relationship between port competitiveness and port throughput

positive moderating effect of institutional environment	Strongly disagree(%)	disagree(%)	Partial disagree(%)	Partialagree(%)	agree(%)	Strongly agree(%)
port facilities conditions and port competitiveness	0	4.71	1.18	25.88	47.06	21.18
port connectivity conditions and port competitiveness	0	3.53	1.18	18.82	56.47	20.00
operation efficiency and competitiveness	0	3.53	0.00	21.18	56.47	18.82
port competitiveness and port throughput.	0	3.53	0.00	25.88	43.53	27.06

In view of the fact that some of the respondents still disagree, partially disagree and partially agree, we take it as the reason why the econometric regression result do not support the hypothesis that institutional environment moderating the relationship between port facilities and the competitiveness of Beibu Gulf port, and institutional environment moderating the relationship between port operation efficiency and the competitiveness of Beibu Gulf port.

Relatively speaking, 76.47% of the respondents agreed or strongly agreed that the institutional environment was moderating the relationship between the port connectivity

conditions and the port competitiveness of Beibu Gulf ports. And the remaining respondents disagreed and partially agreed. The hypothesis, which the institutional environment is positively moderating the relationship between the port connectivity conditions and the port competitiveness of Beibu Gulf ports, is confirmed further.

4.8.2.3Survey results of the relationship between port competitiveness and port throughput of Beibu Gulf Port

In the previous econometric regression analysis, we found that the regression coefficient of Beibu Gulf port competitiveness to port throughput is significantly positive which means that the regression results support the hypothesis that port competitiveness and port throughput are positively correlated. Therefore, we ask the following questions in the questionnaire: "According to the actual situation of Beibu Gulf Port, what is the relationship between port competitiveness and port throughput?” By analyzing the data collected from the questionnaire, we got the basic view on this issue (see Figure 4-5). Among the 91 respondents, 57 believed that the relationship between the competitiveness and throughput of Beibu Gulf port was positive or mutually reinforcing, one believed that there was a negative correlation between them, and one believed that there was no correlation between them. The other 32 respondents believed that the relationship between the competitiveness and throughput of Beibu Gulf port was difficult to describe accurately, so there is no clear view. Since more than half of the respondents believe that the relationship between port competitiveness and port throughput in the Beibu Gulf is positive or mutually reinforcing, we believe that the results of the questionnaire also support the conclusion of hypothesis 7 which is supported by econometric regression results, that is, there is a positive correlation between port competitiveness and port throughput in the Beibu Gulf.

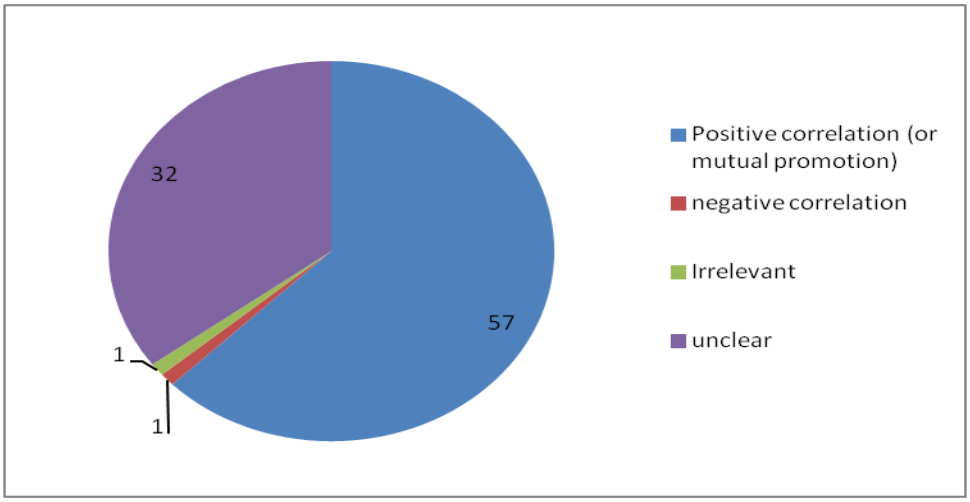

Figure 4-5 Survey results on port competitiveness and port throughput in Beibu Gulf port

4.8.2.4Survey results of the institutional environment positively moderating the relationship between port competitiveness and port throughput of the Beibu Gulf Port

About whether the institutional environment can moderate the relationship between port competitiveness and port throughput positively, 70.59% of the respondents agreed or very much agreed, and the remaining respondents disagreed or partially agreed. Therefore, the conclusion of econometric regression can be supported that institutional environment is positively moderating the relationship between port competitiveness and port throughput.

4.8.2.5Survey results of the port competitiveness of Beibu Gulf Port is the mediating variable of port resources and port throughput

Regarding whether the port competitiveness of Beibu Gulf is an mediating variable between port resources and port throughput: although a certain proportion of respondents, in Table 4-16 and Figure 4-5, have no idea about the relationship between port resources and port competitiveness, and the relationship between port competitiveness and port throughput, Most of the respondents believe that port resources have a positive effect on port competitiveness, and port competitiveness can play a positive role in promoting port throughput. So the results of econometric regression that port competitiveness is an mediating variable between port resources and port throughput can be considered acceptable.

Chapter 5：Discussions and Conclusion

Through the econometric regression analysis of the previous chapters and the investigation of employees of the related operating units in Beibu Gulf port, this study estimated the competitiveness of Beibu Gulf Port, and got the results of the regression test and related conclusions about the theoretical hypothesis. This chapter will use the relevant theory and first-hand survey data to discuss the previous empirical results, and summarize the conclusions of this study, then put forward corresponding countermeasures and suggestions, and finally point out the contributions and weakness of the study.

5.1 Discussions

5.1.1 Analysis on the competitiveness of Beibu Gulf Port

From the perspective of comprehensive technical efficiency (Appendix Table 2-1), dynamic change trend of the thirteen Ports (2010-2016), in the study sample, is relatively stable. The average comprehensive technical efficiency of Beibu Gulf Port is 0.213, while that of Yantian Port, Rizhao Port, Yingkou Port, Tangshan Port, Lianyungang Port and Tianjin Port is above 0.75 per year, while that of Dalian Port, Xiamen Port, Shanghai Port and Ningbo Port is about 0.4. Comparing with other ports in China, the input-output comprehensive efficiency of Beibu Gulf Port is relatively low, which means although Beibu Gulf port has increased its resource investment to improve the port management environment in recent years, the inadequate facilities and the lower management level of the port are still the competitive disadvantages of Beibu Gulf Port, resulting in not ideal port throughput and relatively weak competitiveness.

From the perspective of pure technical efficiency (Appendix Table 2-2), the thirteen ports on the dynamic change trend from 2010 to 2016 also remain relatively stable, the pure technical efficiency in Shanghai port, Tianjin port, Yantian port, Rizhao port and Lianyungang is 1.000, which indicates that these ports are efficient in using their resources at the present

technological level. As for the other ports, it is 0.857 above in Ningbo port, Tangshan port and Yinkou port;it is basically 0.439 in the Zhuhai port, Dalian,and Xiamen port; the pure technical efficiency in Nanjing port and the Beibu gulf port is low, with the average level of only 0.368 and 0.329, respectively. In the horizontal comparison, if the 13 ports are divided into four grades, there is no doubt that Nanjing port and Beibu Gulf port are belonging to the fourth grade. From 2010 to 2015, the pure technical efficiency of Beibu Gulf port is better than that of Nanjing port. However, by 2016, Nanjing port increased sharply to 0.787, while the pure technical efficiency in Beibu Gulf port was only 0.331, making it the lowest one.

From the perspective of scale efficiency (Appendix Table 2-3), the thirteen ports from 2010 to 2016 remain relatively stable same to the above two types of efficiency values. Among them, the scale efficiency value of Beibu Gulf Port is below the middle level, with an average value of 0.654 in seven years, which means that Beibu Gulf Port has not yet been optimized in scale and needs further expansion of berth, wharf and shoreline. The scale efficiency value of Yantian port is the highest, which is at the 1st level for 7 years. The scale efficiency values of Yingkou port, Rizhao port and Tangshan port are also high, ranging from 0.779 to 1.000, but the type of return of scale is unstable, showing an increasing, constant or decreasing state alternately.

The scale efficiency of Xiamen port and Lianyungang decreased slightly, but the average value reached 0.901 and 0.866 respectively in 7 years, and both scale returns increased during this period. Comparing Tianjin port and Dalian port with Xiamen port and Lianyungang, the mean scale efficiency difference is small, which is 0.850 and 0.779 respectively, but the type of scale returns is diminishing. The scale efficiency of Xiamen Port and Lianyun Port declined slightly, but the mean value of scale efficiency of them and 0.866 respectively in seven years, and the scale returns of both increased during this period. Compared with Xiamen Port and Lianyun Port, Tianjin Port and Dalian Port have smaller differences in scale efficiency, which are 0.850 and 0.779 respectively, but the type of scale returns is decreasing. If we make a horizontal ranking based on scale efficiency, Beibu Gulf port ranks 10th, ranking higher than Shanghai port, Ningbo port and Zhuhai port. This reveals that the key reason for the poor comprehensive competitiveness lies in technological aspects, not in

facilities and other scale aspects.

5.1.2 The relationship between port resources and port competitiveness of Beibu Gulf Port

The port resources of Beibu Gulf port mainly include port facilities conditions, port connectivity conditions and port operation efficiency. Through empirical research, it shows that the relationship between them and port competitiveness is not consistent with the previous theoretical hypothesis. Here is a further discussion.

5.1.2.1The relationship between facilities and competitiveness of Beibu Gulf Port

The empirical study results show that the regression coefficient between production length in Beibu Gulf ports of the port facilities condition and port's competitiveness is positive; the regression coefficient between the other two factors, the designed throughput capacity and the cost of production and operation, and port competitiveness of is negative, which means at present in the Beibu Gulf port some facilities conditions can play a positive role in promoting port competitiveness, some facilities condition are not. However, the sum of the regression coefficients of the three indexes is 0.043 due to the three aspects of the Beibu Gulf port comprehensive facilities conditions, which indicates that the port facilities conditions have promoted the competitiveness of the Beibu Gulf port when all other things are held constant, which proves the establishment of the hypothesis 1, the port facilities and the port competitiveness are positively correlated.

This conclusion is consistent with the results found by most researchers that the port facilities can play a positive role in promoting the competitiveness of the port, for example, it is pointed out by Si (2012; 2015) that the port facilities has led to the heterogeneity of the different port cities, the city's economy with the rapid construction of port facilities develops rapidly. It also improved the competitiveness of the port (Si, 2012; 2015). Li (2016) studied the factors that affect the competitiveness of the port, including the basic equipment status, collection and transport capacity, hinterland regional economy, auxiliary production capacity, information technology level and operation management level (Li, 2016). Again, according to a study by Peters (1990), it was revealed that equipment operation ability and

equipment status have an important impact on port competitiveness.

In fact, through surveys about the Beibu Gulf port management department and the chief executives of the enterprise, the investigators are asked to answer "what is more important in the port facilities conditions?" "What is the relationship between port facilities conditions and port competitiveness?" Most of the respondents also believed that the port facilities conditions were positively related to the competitiveness of the port. However, port operators of different positions and working years have different views on the importance of port facilities. Among them, middle-level and below managers think that operation equipment is the most important facilities, while senior managers think that port channel and wharf are the most important facilities. Those who worked for less than 10 years thought that operation equipment was the most important facility. Those with more than ten service years of work considered that the most important facilities are port channel and wharf. However, the people in charge of the port management department said that at present, the tonnage level of the container terminal at Beibu Gulf port is low, the deepwater port channel is still under construction, and the front-line employees of enterprises pointed out the shortage of berths and equipment at the port.

Therefore, at present, the port facilities in the Beibu Gulf port can play a positive role, and some facilities are not yet in place or developed. The reasons making the port facilities in Beibu Gulf be not good enough to promote the competitiveness of the port in this study, may be one or several or many effects of the related factors in the above analysis. In general, the port facilities conditions have promoted the competitiveness of the Beibu Gulf port, but the Beibu Gulf port scale has not been optimized at present. There is the need to further expand the scale of construction in berth and quay coastline.

5.1.2.2The relationship between port connectivity conditions and port competitiveness of Beibu Gulf Port

The empirical results show that there is no correlation between port connectivity conditions and port competitiveness of Beibu Gulf port (P value is 0.998), which is inconsistent with the previous theoretical belief that port connectivity conditions and port competitiveness are positively correlated, there are several reasons: First, although the

number of Beibu Gulf port routes is increasing, the increase of the routes brings problems such as the concentration of logistics companies, the intensification of shipping density and the insufficient capacity of route coordination. The logistics personnel of the port of Beibu Gulf who were investigated also believed that at present, the port of Beibu Gulf has some shallow channels, few pilots and complicated logistics joint inspection, which is difficult to meet the shipping demands of logistics enterprises all the time. Second, the hinterland of Beibu Gulf port is relatively backward, which makes the port at a disadvantage competitive position. It also leads to the inadequate adaptation of the scale of collection and distribution facilities of the Beibu Gulf port to the economic scale of the Beibu Gulf city, which hinders the improvement of the competitiveness of the Beibu Gulf port. Third, the connection points among Beibu Gulf ports are relatively weak, and the interaction among the port citis is not enough, which limits the capacity of routes coordination and the capacity of passage between the port and the inland, thus affecting the competitiveness of the port. Fourth, competitive bidding of shippers and shipping companies are also a determinant of the competitiveness of container ports(Voorde & Winkelmans,2002). However, a certain proportion of respondents believe that Beibu Gulf Port is in a price disadvantage, which to some extent affects the improvement of port competitiveness. Finally, the connection between the upstream and downstream enterprises related to the port is not smooth enough. These factors weaken the competitiveness of Beibu Gulf port to a certain extent. In particular, the logistics enterprises related to the port have not been able to play a good role in connection with the port. On the contrary, they still have vicious competition behaviors, which is not conducive to the improvement of the competitiveness of Beibu Gulf port. Therefore, the port enterprises under investigation proposed to strengthen cooperation, avoid disorderly competition and realize the win-win situation of "1+1 > 2".

5.1.2.3The relationship between operation efficiency and competitiveness of Beibu Gulf Port

The empirical results show that the port operation efficiency and competitiveness of the Beibu Gulf port has positive relationship (regression coefficient is 0.622), and the general thinking is that the management efficiency of the port and the port competitiveness present

positive correlation, which is also consistent to the results of questionnaires carried out in this study, which suits most people’s expectation that the port operation efficiency and competitiveness should be a positive correlation. That means with integrating the three ports of Qinzhou port, Beihai port and Fangcheng port into a unified Beibu Gulf port, a certain amount of duplication and business competition between the three sub ports has been well coordinated, which is beneficial to the improvement of the operation efficiency of the Beibu Gulf port and thus better promote the competitiveness of the port.

However, the marginal effect of improving port operation efficiency on port competitiveness is still relatively small. In the future, we should further coordinate the relationship between the three sub ports. Since it is necessary to improve the internal management system of the port and improve the level of port management and service. This process involves the need of local governments of the port cities to promote the local economy development, the trade-off of benefits between the main facilities construction for connecting ports and the units which use them, and the integration and development of the upstream and downstream enterprises out of the Beibu Gulf port. The existence of these problems will not benefit the further improvement of the port operation efficiency, which will affect the role of the port management efficiency in promoting the port competitiveness. In addition, through investigation, some members of the Beibu Gulf Port Group believe that the Beibu Gulf port group has the nature of state-owned enterprises. At present, the personnel system of the enterprise is relatively traditional and solidified, and the enterprise's vitality is not strong, which makes the port operation efficiency slow. Therefore, the reform of the Beibu Gulf port enterprise should be accelerated and improve the operation efficiency of the port, which will further speed up the port competitiveness of the Beibu Gulf port.

5.1.3 The relationship between port competitiveness and port throughput of Beibu Gulf Port

The results of econometric regression test and more than half of the respondents (See Figure 4-5) both hold that the competitiveness of Beibu Gulf port has a positive effect on port throughput. The stronger the competitiveness of Beibu Gulf port is, the larger the port

throughput. The reason is that the improvement in Beibu Gulf port transport capacity, port facilities, logistics supply capacity and other aspects lead to the increase in cargo throughput, container throughput and other indicators. The empirical results are consistent with the viewpoints from Mo and Cheng (2017)--the greater the cargo throughput, the stronger the capacity of the port to carry the cargo, the greater the port's dominance of the market. They came to this conclusion by using cargo throughput, container throughput and other indicators to evaluate port competitiveness. At the same time, it is also consistent with the empirical conclusion from Sun et al. (2013), who agree that the competitiveness of the port has a significant promotion effect on the port throughput, with the research on the port competitiveness of Shanghai port and Tianjin port. They think that the enhancement in Shanghai port and Tianjin port competitiveness, promotes the port cargo throughput growth rate and passenger throughput growth rate (Sun et al., 2013).

Compared with the ports with significant relationship between the port competitiveness and the throughput (Table 4-10), Shanghai port, Tianjin port and Dalian port have high elasticity coefficient. In a certain extent, the competitiveness of the Beibu Gulf port is not particularly ideal for its throughput increase. It can be explained that the factors affecting the competitiveness of the port are comprehensive, multilevel complex systems (Zhou, 2017), which includes natural resources, dock facilities, port economic hinterland, cargo gathering, logistics services, foreign trade, routes, and collection transport systems (including railway, highway, aviation and sea rail transport.), as well as the comprehensive representation of the superposition of multiple factors, such as management level, industry and macroeconomic policy. The Beibu Gulf port competitiveness, although supported by several factors superposed or integrated, has produced strong competitiveness to promote the improvement of the port throughput in the Beibu Gulf, but compared with the other developed coastal ports in China, at present, the mechanism of improving the port competitiveness in Beibu Gulf and promoting the increase of port throughput is not yet perfect.

5.1.4 The moderating role of Beibu Gulf Port institutional environment on the relationship between port resources and port competitiveness

5.1.4.1The moderating effect of Beibu Gulf Port institutional environment on the relationship between port facilities and port competitiveness

The institutional environment has passed the test on the interaction of the designed throughput capacity of the Beibu Gulf Port with a significant level as 0.1. However, although the interaction items of the port shoreline length and the institutional environment, the port production and operation cost and the institutional environment have all passed the test, but correlation coefficient is negative. The sum of the regression coefficients of the interaction terms between the three indicators of port facilities and the institutional environment is -0.005, which reflects that the institutional environment of Beibu Gulf Port plays a role in regulating the relationship between the port facilities and the competitiveness of the port, but it does not currently moderate the relationship between the port facilities and the port competitiveness positively, to some extents it plays an inhibitory role. Therefore, the hypothesis in this study that the institutional environment of Beibu Gulf port moderates the relationship between port facilities and port competitiveness positively does not be supported.

To the former, a possible reason is that the Beibu Gulf Port is a cluster of ports, the governments give full play to the active role of them in the port economy activities, different port city governments build public environment together, and create mutual consultation and coordination with self-discipline, efficient and capable port management system, establish and improve the relevant aspects of a benign mechanism for coordination, negotiation and collaboration, thus forming a new situation of port group with highly efficient, unified and harmonious development (Tu, 2006). The institutional environment of Beibu Gulf port strongly promotes its improvement in navigation channel mode, channel or route capacity. However, the designed throughput capacity of Beibu Gulf port is quite different from other ports, so the institutional environment has passed the test on its interaction with the designed throughput capacity.

As to the reasons for the interaction coefficient between port shoreline length and

institutional environment, and the interaction coefficient between the port production and operation cost and the institutional environment are both negative, mainly because that although China has issued many favorable policies: “Opening-up of Seashore, River Shore and Border Areas” initiative policies for the development of Beibu Gulf Port, the direct measures to promote the port development in Beibu Gulf Port are the specific policies such as fiscal and tax policies, in the views of the senior managers and the staff with many years of experience. As a whole, Guangxi's total marketization index score shows a trend of gradual increase over time. However, from a nationwide perspective, Guangxi's total marketization index score is still low among 31 provinces, autonomous regions and municipalities, and its marketization level is still low, and its institutional environment needs to be further optimized.

5.1.4.2The moderating effect of Beibu Gulf Port institutional environment on the relationship between port connectivity conditions and port competitiveness

Beibu Gulf port system environment has positive effect in moderating the relationships between port connectivity conditions and port competitiveness, this depends on the much work carried out by Beibu Gulf port in promoting the association of south-east Asian nations port logistics cooperation, such as pushing forward the construction of the connectivity south channel between China and Singapore, with Guangxi, Chongqing and Gansu as the key nodes. In addition, Guangxi has focused on building the China-Asean port city cooperation network, basically built a three-dimensional transportation network that serves China-Asean port logistics cooperation. Beibu Gulf port has also become an important hub connecting Asean port cities.In addition, according to the survey of this study, the local governments in Beibu Gulf port area introduce some subsidy policies for liner service and construction of new routes, all of such system construction has improved the related institutional arrangements on the port connectivity condition construction, which can attract more logistics enterprises to participate in and promote Beibu Gulf port external connectivity, and thus improve Beibu Gulf port competitiveness. What needs to be explained is that Guangxi has not formed a complete institutional mechanism to coordinate the integration of customs with the surrounding provinces and municipalities and ASEAN countries in the service for the Southerly Transport Corridor between China and Singapore. In a certain process, some

enterprises under investigation believe that at present, customs clearance preparation and goods removal in Beibu Gulf port are not very ideal, and the compliance cost related to container import and export is still high. Therefore, it is necessary to further improve the institutional environment, and then the marketization index of the Beibu Gulf Economic Zone, perfect the port connectivity conditions and improve the competitiveness of Beibu Gulf port.

5.1.4.3The moderating effect of Beibu Gulf Port institutional environment on the relationship between port operation efficiency and port competitiveness

At present, the institutional environment of Guangxi Beibu Gulf port does not play a positive role in moderating the relationship between the port operation efficiency and the port competitiveness. The following are the reasons: First, the business environment in Beibu Gulf port is not perfect enough to affect the improvement of the operation efficiency in this area, for example, according to the data released from the Administration Office of Service Center in Autonomous Region Government , Guangxi has found 144 environmental problems during self correction and optimization of the business environment in February 2018, including 6 problems on project examination and approval, 2 problems on enterprise licenses, 26 problems on factors supply, 14 problems on human resources services, 15 problems on financing services, 16 problems on tax collection management and 2 problems on customs clearance, all of which are not conducive to the improvement of port operation efficiency. Second, in 2013, although the government pushed the integration of Qinzhou port, Fangcheng port and Beihai port, it is still difficult for Beibu Gulf port group to have the right to make free decision because its nature of state-owned enterprises. So some management decisions will lag behind the market situation, and it is difficult to make effective management decisions. In addition, the institutional environment includes both formal and informal rules, which are designed to restrict the individual behavior in order to pursue the utility of subject or the maximization of welfare. At the same time, it not only restricts the behavior of individuals, but also affects the efficiency of the allocation of resources, and even plays an important role in economic growth and economic development in various countries (North, 1999). Different port enterprises face different restrictions on the scope of decision-making. As the decision-making authority of Beibu Gulf port is lower than that of the private

enterprise, the influence of the institutional environment on the relationship between port management efficiency and Port Competitiveness is limited. Third, because the improvement of operation efficiency in Beibu Gulf port is affected by the overall economic situation, especially the economic development level of Guangxi is relatively backward, so even if the institutional environment in Beibu Gulf port is greatly improved, as long as there is no large-scale and high quality hinterland economic environment, the port business efficiency of Beibu Gulf port still plays a weak role in pulling port competitiveness.

5.1.5 The regulatory effect of institutional environment in Beibu Gulf Port on the relationship between port competitiveness and port throughput

This study proves that the interaction correlation coefficient between Beibu Gulf port institutional environment and port competitiveness is significant at the 10% confidence level, which indicates that the institutional environment of Guangxi Beibu Gulf port plays a role in moderating the relationship between port competitiveness and port throughput. In the context of economic globalization, since foreign direct investment and international transport enterprises are threatening the port development field (Yang, 2011). Therefore, China is constantly strengthening the legislation, ensuring the economic security of the port state, creating a good institutional environment for the development of Beibu Gulf port, and promoting the institutional environment to regulate the relationship between the port competitiveness and port throughput in Beibu Gulf port. As far as Beibu Gulf port itself is concerned, on one hand, the overall institutional environment is conducive to the improvement of the marketization index, which reduces the government's administrative intervention to the port enterprises and restricts the port charges. The greater the port's impact on the market, the greater the throughput of the port, and the stronger the capacity of port to carry the cargo. On the other hand, enterprises choose the most valuable supply chain management for their own, and do not blindly imitate the supply chain management method of large enterprises (David, 2007). According to investigations of some enterprises, some enterprises think the measures such as port management department optimizes the customs clearance process, arranges the priority of the import and export of the container, the preferential road toll in port area, and a series of preferential policies of Qinzhou bonded port

area, all above have played a great role in promoting its business expansion.

5.2 Research conclusions

Guangxi Beibu Gulf port, as the gateway and frontier of "The belt and road" strategy, especially the 21st Century Maritime Silk Road, is vigorously promoting the development of port economies and the surrounding cities as strategic mission. The core in developing the port economy is to develop the port itself, improve the port facilities, strengthen the port industry, and constantly improve the comprehensive competitiveness of the port. In the final analysis, the development of port economy is the process of developing and upgrading of the port itself and its comprehensive competitiveness.

This thesis studies the competitiveness of Guangxi Beibu Gulf Port, selects 12 main ports, such as Zhuhai port and Tianjin port as comparison objects, and selects the data from 13 ports such as Beibu Gulf port, Shanghai port and Yantian port during 2010-2016, analyzes the current situation of the competitive power in Guangxi Beibu Gulf port, and makes clear the existing problems. Based on quantitative, qualitative and multi-disciplinary research methods, a large number of first-hand data from Guangxi Beibu Gulf port is collected, analyzed its present situation, construct theoretical model with many variables and elements, including port competitiveness, port facilities, port connectivity conditions, port operation efficiency, port throughput and institutional environment. On this basis, the model can be concluded and integrated to complete the research mission of enhancing the port competitiveness of Guangxi Beibu Gulf port based on resource and institutional theory.

Through the analysis and research in the preceding chapters, the main conclusions are as follows:

5.2.1 The overall competitiveness of Guangxi Beibu Gulf Port is weak

In this study, we take the BCC model as the theoretical basis, and select the data of 13 ports such as Guangxi Beibu Gulf Port, Shanghai port and Yantian port during 2010-2016. From the perspective of comprehensive technical efficiency, the comprehensive technical

efficiency of Guangxi Beibu Gulf port is low. During 2015 and 2016 consecutive two years, its comprehensive technical efficiency is the lowest and competitiveness the weakest in the 13 ports. From the perspective of pure technical efficiency, from 2010 to 2015, the pure technical efficiency of Guangxi Beibu Gulf port was only superior to that of Nanjing port. In 2016, Guangxi Beibu Gulf port became the lowest in pure technical efficiency. In terms of scale efficiency, Guangxi Beibu Gulf port scale efficiency value is below average level, it ranks the 10th, higher than Shanghai port, Ningbo port and Zhuhai port , which explains the key reason for Guangxi Beibu Gulf port poor comprehensive competitiveness is at the technical level, the scale level factors such as the facilities, are not the key reasons; From the perspective of scale reward, Guangxi Beibu Gulf port belongs to the type of increasing returns to scale, which indicates that Guangxi Beibu Gulf port has not yet been optimized in scale and needs to further expand the scale construction of berths and wharf shoreline. Generally speaking, Guangxi Beibu Gulf port competitiveness level is weak.

5.2.2 The competitiveness of Guangxi Beibu Gulf Port is positively related to port throughput

The port cargo throughput is one of the important indicators to measure the efficiency of port production and operation. It is the direct embodiment of its international port status, ocean transportation status, and the transfer status of water and land transport system. It is also a quantitative reference standard to measure the social development and economic construction of countries, regions and cities in which the port is located. The results of the empirical analysis show that the competitiveness of Guangxi Beibu Gulf port competitiveness is significantly positive to the throughput, which shows that the competitiveness of Guangxi Beibu Gulf port can promote the increase of port throughput. The growth of port throughput in Guangxi Beibu Gulf is significantly affected by port competitiveness. There are many factors involved in port competitiveness, including port natural resources, public facilities, port economic hinterland, cargo gathering, logistics services, foreign trade, routes, collection and transportation system (including railway, highway, aviation and sea rail transport.), and still the comprehensive expression of multiple factors superposition such as management level, industry and macroeconomic policies. The competitiveness of Guangxi Beibu Gulf port

may be superimposed or integrated by some factors among the above, and result in a strong competitiveness to promote the improvement of port throughput in Guangxi Beibu Gulf port.

5.2.3 Not all of Guangxi Beibu Gulf Port resources have significantly affected port competitiveness

The production length of the port shoreline in the Beibu Gulf port facilities has a significant positive impact on the port competitiveness. It shows that the government has given some effect to the optimization and integration of Guangxi Beibu Port in recent years. The other two factors, the designed throughput capacity and the cost of production and operation, have a significant negative impact on the competitiveness of the port. It shows that the port facilities in Beibu Gulf port can play a positive role in promoting the port operation, and some facilities are not perfect enough to promote the competitiveness of Beibu Gulf port. The main reason is that Guangxi Beibu Gulf port is still not optimized on the scale at present. It is necessary to further expand scale construction such as berth and quay coastline.

The role of Beibu Gulf port connectivity conditions is not significant to enhance the port competitiveness. The main reason is that the coordination capacity of the port route cannot meet the needs of the rapid development of Beibu Gulf port connectivity condition (Logistics Company). The condition of the port collection and transportation facilities in the Beibu Gulf port is not suitable for the scale of the Beibu Gulf cities. The connections between Beibu Gulf ports are relatively weak, and the interaction between ports and cities is not enough, and the links between upstream and downstream businesses related to ports are not smooth enough.

The operation efficiency of Beibu Gulf port has a significant impact on the competitiveness of the port. It shows that after the integration of the three ports of Qinzhou port, Beihai port and Fangchenggang into a unified Beibu Gulf Port, the three sub ports have been well coordinated, which is beneficial to the promotion of the operation efficiency in Beibu Gulf port, thus better promoting the efficiency of the port. However, the marginal effect of improving the efficiency of port operation on the enhancement of port competitiveness is still relatively small, and the relationship between the three sub-ports should be further coordinated in the future.

5.2.4 The institutional environment of Guangxi Beibu Gulf Port failed to fully moderate the relationship between port resources and port competitiveness

Although the institutional environment of Guangxi Beibu Gulf port plays a role in moderating the relationship between port facilities and port competitiveness, it does not currently moderate the relationship between port facilities and port competitiveness positively, but plays an inhibitory role. The main problem is that the institutional environment plays a positive role in moderating the relationship between the designed throughput capacity of the Beibu Gulf port and port competitiveness, but it does not simultaneously adjust the relationship between the length of port coastline and port competitiveness, the relationship between the cost of port production and operation and the competitiveness of the port.

The main reason is that the overall index of Guangxi marketization is relatively low comparing to the level of marketization of other provinces in China. Although Beibu Gulf Economic Zone develops faster in Guangxi, its advantages have not yet appeared which leads to a failure in positive moderating effect of institutional environment.

The institutional environment of Guangxi Beibu Gulf port plays a role in moderating the relationship between the port connectivity conditions and the competitiveness of the port. The main reason is that the area of Beibu Gulf port has carried out a great deal of work in promoting the logistics cooperation of the ASEAN ports, and the institutional arrangements related to the port connectivity condition construction have been gradually improved.

The institutional environment of Guangxi Beibu Gulf port can not play a positive role in moderating the relationship between the port management efficiency and the port competitiveness. The possible reason is that the business environment in Beibu Gulf port is not perfect, the free decision-making right of Beibu Gulf port is missing, and the hinterland economy is relatively backward. So even though the institutional environment has been greatly improved, the port business efficiency of Beibu Gulf port still plays a weak role in pulling port competitiveness.

5.2.5 The port institutional environment of Guangxi Beibu Gulf has a positive moderating effect on port competiveness and port throughput

The institutional environment of Guangxi Beibu Gulf port plays a positive role in moderating the relationship between port competitiveness and port throughput. The improvement of the marketization index reduces the administrative intervention of the government to the port enterprises, restricts the government and other related departments to charge the port. The moderating effect of the market on the port and the dominating effect of the port to the market are both remarkable. This two-way effect has effectively improved the port cargo throughput and strengthened the capacity of the port to carry the goods.

5.3 Policy implications and suggestions

In summary, the enhancement of the competitiveness of Beibu Gulf port can effectively promote the improvement of port throughput, and the institutional environment can also positively regulate the relationship between the competitiveness of Beibu Gulf port and port throughput. But the overall competitiveness of Beibu Gulf port is weak. Because port resources could not all positively promote the improvement of port competitiveness; the institutional environment of Beibu Gulf port has not fully positively moderated the relationship between port resources and port competitiveness. Therefore, from the perspective of port resources and institutional environment, this study puts forward countermeasures to promote the competitiveness of Guangxi Beibu Gulf port.

5.3.1 Strengthen port software resources construction

According to the previous analysis, the comprehensive technical and efficient value of Guangxi Beibu Gulf Port is low. For example, 2015 and 2016 consecutive two years are the lowest comprehensive technical efficiency and the weakest in the 13 ports, which shows that the resource allocation ability and the resources utilization efficiency are low; the pure technical efficiency of Beibu Gulf port is the lowest in 2016, indicating that factors such as management and technology are at a lower level. All of these indicate that the key reason for

the poor comprehensive competitiveness of the Beibu Gulf port in Guangxi is the technical level, and the facilities scale is not the key cause of its backwardness. It is necessary to work hard on software construction to improve the port competitiveness.

Guangxi Beibu Gulf port is a growing port with good development momentum, and its growing port characteristics determine that the software facilities construction speed of Guangxi Beibu Gulf port lags behind the construction speed of hardware facilities such as waterway, wharf and port public supporting facilities.Guangxi Beibu Gulf port should actively create a good comprehensive port operation environment and improve the construction level of port software facilities:First, talent is a key factor in port software facilities. Guangxi Beibu Gulf should increase the training and introduction of port service talents, port operation talents, port shipping talents and other types of talents, and give priority to supporting colleges and universities in Beibu Gulf economic zone such as Guangxi university and Qinzhou college to set up navigation majors, so as to transport intermediate and senior port development talents for the development of Guangxi Beibu Gulf port.Secondly, port service is a standard that reflects operation level and an important content of customer evaluation. Guangxi Beibu Gulf Port should vigorously develop port operations, such as port finance, freight information consultation, shipping insurance, leasing business, shipping agent, settlement payment, logistics service, maritime support and marine disaster warning.In the end, we should carry out a multi-directional and multi-level port operation business system, establish the leading industry represented by shipping registration, ship technology, shipping brokerage, shipping consulting.The function of port enterprise group, the port industry chain and the port production factor agglomeration should be fully brought into play, and build Guangxi Beibu Gulf port into the port factor agglomeration center for comprehensive operation by integrating region and port, and to be a leading area for port development in line with international standards.

5.3.2 Improve port hardware facilities

The port facilities are positively related to the competitiveness of the Beibu Gulf Port, but some of the facilities are not yet perfect, and can not promote the competitiveness of

Beibu Gulf Port well. The main reason is that Guangxi Beibu Gulf Port is still not optimized on the scale and needs further construction of port hardware.

The port hardware facilities include port geographical location, the length of the dock production line, the designed channel capacity and the area of anchorage. It is the reflection of the port geographical position and the ports own conditions. The port hardware facilities are the key factors affecting the development of port. For the port, the length of the quay, the designed channel capacity, the area of anchorage and the cost of the operation of port are the hard indexes to measure the port resources, and it is also an important factor to attract the source of cargo. Guangxi Beibu Gulf port is in an important transformation and upgrading stage. it is very important to explore port resources during this process scientifically.Guangxi Beibu Gulf port should relocate the port of Qinzhou port group (Le Gou), Qinzhou bonded port (Da Lan Ping), Beihai Qiaogang dock, Beihai deepwater port wharf and Fangchenggang container terminal, and further integrate the land resources, appropriately optimize the layout of the wharf, if necessary,to carry out large-scale relocation and renovation, improve the utilization ratio of the advantageous coastline and wharf resources in Guangxi Beibu Gulf port.the construction of the port public facilities is the basic part of the port's hardware facilities, including hydropower facilities, railway and highway collection and transportation channels, electronic communication facilities, environmental protection, signal, information platform and other facilities.Improving the overall level of public supporting facilities of the three major ports in Guangxi Beibu Gulf is conducive to improve the efficiency of port operation and improve the level of port services.The key points are to speed up the construction of Qinzhou Jinggu River waterway project, Qinzhou port 300 thousand ton waterway project, Qinzhou Beibu Gulf ten millions of TEU modern port project, Tieshan port area channel two phase dredging extension project. In Beibu Gulf coastal port, a brand port operation area is formed with large scale, professionalization and modernization, perfect public facilities and excellent port customs clearance service, which will promote the brand awareness of the whole Guangxi Beibu Gulf Port, and then increases the competitiveness of Guangxi Beibu Gulf port.

5.3.3 Improve port operation efficiency

The operation efficiency of Beibu Gulf Port has a significant impact on the port competitiveness. It shows that with integrating the three ports of Qinzhou port, Beihai port and Fangcheng port into a unified Beibu Gulf Port, the three sub ports have been well coordinated, which is beneficial to the promotion of the operation efficiency of Beibu Gulf Port, thus better promoting the efficiency of the port. However, the marginal effect of improving port operation efficiency on port competitiveness is relatively small, and the relationship between the three sub ports should be further coordinated in the future.

Port logistics industry is an important carrier of port economic development, and also a core index of port operation efficiency. The scarcity of port resources and the uniqueness of port business make port logistics enterprises have a congenital development advantage. Under the current economic development situation, the port competition has shifted from the cost oriented competition to the quality oriented competition at the middle end, and then to the high-end service oriented competition. In this environment, Guangxi Beibu Gulf port should vigorously develop the logistics industry, and it is imperative to improve the logistics service level in an all-round way. Port logistics services are divided into three levels: core, auxiliary and extension. The first is the core service of cargo handling and transportation. The second is to use advanced loading and unloading machinery and transport tools to assist in the loading and unloading, transportation, stacking and storage of auxiliary services in a specific freight yard, and the third is to provide customers with excellent and convenient extension services for the delivery of goods. At present, most of the port logistics enterprises in Guangxi Beibu Gulf port still remain in the simple core service level, the development of auxiliary service and extension service is insufficient, and the planning of overall management of logistics and the ability of fine organization are lacking. Guangxi Beibu Gulf port logistics industry should be the modern service industry. The development of port logistics enterprises should focus on customer demand, pay attention to the differences of customers, shape the port logistics enterprise image, improve the logistics service level, and enhance the competitiveness of Guangxi Beibu Gulf port.In addition，Guangxi Beibu Gulf port includes Fangcheng port, Qinzhou port and Beihai port. Under the new situation of economic and social development,

accelerating Guangxi Beibu Gulf port cooperation is an effective way to improve the operation efficiency of Beibu Gulf port.Fangcheng port will vigorously develop the bulk cargo transportation system; Qinzhou port will focus on petrochemical transportation system and container transportation system. The development of Beihai port will focus on the large international cruise ships passenger transportation system, trade center and clean material transportation system .Based on this, we should accelerate the cooperation and integration of the three major ports and carry out in-depth cooperation in terms of cargo sources, systems and funds.Based on the viewpoint of supplier cooperation, the three major ports should moderately expand shipping proportion in the whole transportation volume. The shipping lines of the ports are mutually oriented and branch lines. As far as possible, transshipment of containers from overseas ports previously jointly operated by the ports should be carried out by the ports jointly operated by the three ports instead. From the perspective of system cooperation, the three ports adopt unified charging standard, avoid the contradiction caused by mutual competition on price reduction, and promote the healthy and harmonious development of the ports. In terms of port construction management, the structure of the three major ports should be optimized according to their respectively geographical location, development priorities, types of goods and flow of goods.From the perspective of capital cooperation, Guangxi Beibu Gulf port takes capital as the link and integrates resources by means of mutual participation, joint venture, merger and reorganization among port enterprises, so as to realize common interests.The three ports, through complementary resources and complementary advantages, complement each other, carry out deep cooperation, and develop the brand difference between the three ports in Guangxi Beibu Gulf port . It is beneficial to give full play to the advantage of Beibu Gulf port in market competition, to avoid the repeated construction and business competition in some areas of the three ports, and to strengthen the port coordination and cooperation, which can effectively enhance port operation efficiency and promote port competitiveness.

5.3.4 Optimize the institutional environment for the development and utilization of port resources

According to the marketization index of 13 ports in 2010-2016 in Figure 4-4, the

institutional environment of Beibu Gulf Port, which is evaluated by the "total marketization index score", is constantly optimized, but there is a clear gap between the institutional environments of other ports. Therefore, it is necessary to further optimize the institutional environment for the development and utilization of Beibu Gulf port resources and promote the enhancement of the competitiveness of Beibu Gulf port.

In view of the fact that the institutional environment of the Beibu Gulf Port can positively moderate the relationship between port conectivity conditions and port competitiveness, it is necessary to continue to strengthen communication with Chongqing, Gansu, Sichuan and other provinces, improve the institutional arrangement of China-Singapore strategic southbound corridor, and improve coordination with neighboring provinces, municipalities and ASEAN countries to promote system and mechanism of the customs clearance integration.

Given that current institutional environment has a negative moderating effect on the relationship between port operation efficiency and the competitiveness of Beibu Gulf Port, On the one hand, the Beibu Gulf Port Group, a state-owned enterprise, should be reformed in terms of personnel appointment, management decision-making and financial management, with the separation of government and enterprise as the ultimate goal of the reform. On the other hand, the operational environment of port operation units should be optimized to provide convenience for port operation units in project approval, human resources services, financing services, fees and taxes collection and management, and customs clearance.

Guangxi Beibu Gulf port has great influence and value on the "The belt and road" strategy and the whole regional development in Beibu Gulf economic area. It is urgent to the Beibu Gulf port of Guangxi to seize the opportunity and strive for the policy supports of "The belt and road" and the state's support for the development of the Beibu Gulf Economic Zone. China should formulate specific policies for the development of Guangxi Beibu Gulf port as soon as possible, guide and support the three ports in Guangxi Beibu Gulf to participate in regional economic development, and strengthen the strategic cooperation of Guangxi Beibu Gulf port to participate in "The belt and road", and the construction of software and hardware facilities and logistics network in Guangxi Beibu Gulf port should be strengthened in advance

to meet the needs of international trade development in countries along the "The belt and road" strategy, so as to make preparations for the commercial operation of Guangxi Beibu Gulf port to occupy the development opportunity in countries along "The belt and road", to promote the Beibu Gulf port become a truly competitive international port.

5.4 Research contribution and weakness

5.4.1 Research contribution

5.4.1.1Theoretical contribution

By combining the previous literatures of scholars on the relationship between port resources, institutional environment and port competitiveness, this study puts forward a theoretical framework for studying regional port competitiveness from the perspective of port resources and institutional environment, which can further enrich the existing theories on regional port competitiveness. Building a panel data econometric regression model, the empirical analysis found that port resources affect the change of the port throughput through port competitiveness as a mediation variable, and institutional environment can play a moderating role not only between port competitiveness and port resource, but also between port competitiveness and port throughput, thus revealing the mechanism between port resources, institutional environment and port competitiveness in theory.

5.4.1.2Practical value

According to the panel data of 13 ports along China's coast, using the measurement model of individual variable coefficient of cross section the empirical to verify the relationship between institutional environment, port resources and port competitiveness in Beibu Gulf Port, with questionnaire survey and data to further verify and interpretate the results of regression, this study gives the empirical study conclusions on the relationship between Beibu Gulf Port resources and competitiveness, the relationship between port competitiveness and port throughput, the moderating role of institutional environment in Beibu Gulf Port on the relationship between port resources and port competitiveness, the

relationship between port competitiveness and port thoughput, and provides decision-making reference for relevant departments.

5.4.2 Limitations and future research

5.4.2.1Limitations

Although this study collected a large number of data to study the problems related to the competitiveness in Beibu Gulf Port, the following research weaknesses still are acknowledged and discussed. First, Guangxi Beibu Gulf Port Group was set up after integrating Qinzhou Port, Beihai Port and Fangchenggang in 2007. The relevant statistics and data of Beibu Gulf Port have not been improved until 2010, which affects the time span selection and variables measurement in this study. The sample size of the model is relatively small, and the robustness test of the model can not be carried out. Second, questionnaires investigations were conducted on employees of Beibu Gulf Port. Due to the wide geographical scope and large number of people who needed to be investigated, the breadth and representativeness of the questionnaire survey may not be particularly ideal, and it can only be used as the auxiliary data of this study.

5.4.2.2Future Research

With the continuous development of Beibu Gulf Port and the improvement of subsequent research data, it will be possible to conduct a comprehensive and in-depth study on the competitiveness of Beibu Gulf Port with a larger sample capacity. In addition, in the future, based on the first-hand data collected in the early stage, the investigation scope can be further expanded to form a larger and more comprehensive statistical database on Beibu Gulf Port operating units, providing a basis for the subsequent quantitative research on micro-enterprises. Finally, with the further development in econometrics theory and the continuous improvement of modern advanced econometric analysis methods, the in-depth quantitative analysis on port resources, institutional environment and port competitiveness will be more convincing.

[This page is deliberately left blank]

Bibliography

Andrews, K. (Ed.). (1971). *The Concept of Corporate Strategy*. Homewood, IL: Dow Jones-Irwin.

Ansoff, H. I. (Ed.). (1965). *Corporate Strategy: An Analytical Approach to Business Policy for Growth and Expansion*. New York: Mc Graw-Hill.

Asgari, N., Hassani, A., & Jones, D. (Eds.). (2015). Sustainability ranking of the UK major ports: methodology and case study.*Transportation Research Part E: Logistics and Transportation Review*, 78(8), 19-39.

Bai, Y. X. & Wang, S.J. (Eds.). (2014), The deep background and geo-strategy of the silk road economic belt. *Reform*, (03), 64-73.

Barney, J. B. (Ed.). (1986).Strategic Factor Market: Expectation Luck and Business Strategy.*Management Science*, 42, 1231-1241.

Barney J. B. (Ed.). (1991). Firm resources and sustained competitive.*Journal of Management*, 17, 99-120.

Berry, H., Guillen, M. F., & Zhou, N. (Eds.). (2010). An institutional approach to cross-national distance. *Journal of International Business Studies*，41(9), 1460-1480.

Bo, X.P. & Yi, Y.F. (Ed.). (2007), A summary of domestic and foreign enterprise competitiveness research . *Commercial research*, (12), 11-16.

Cao, H.H. (Ed.). (2015), "The belt and road" promotes the balance of the world economy, *People Daily*. 7, 12.

Chang, Y., Lee, S., & Tongzon, J. L. (Eds.). (2008). Port selection factors by shipping lines: Different perspectives between trunk liners and feeder service providers, *Marine Policy*, 32, 877-85.

Cheng, H. (Ed.). (1996). On the formation mechanism and development process of the regional combination of seaports. *Acta Geographica Sinica*, (06), 501-507.

Cheng, Z.M., Xia, X.P., & Yu, M.G. (Eds.). (2008).Government intervention, Pyramid structure and investment of local state-owned listed companies. *Management World*, (09), 37-47.

Cheng, J.W. (Ed.). (2006). *Research on the evaluation and development strategy of Qingdao international container port competitiveness*, Master Thesis, Dalian Maritime University.

Cheng, C.B., Mao, J.X., & Li, L.Q. (Eds.). (2017).Study on marine industry adjustment of Guangxi Beibu Gulf economic zone under the strategic background of Belt and Road, *Journal of Guangxi Teachers Education University(Natural Science Edition)*, (01), 103- 112.

Chiu, R. H. (Ed.). (1996). *Logistics performance of liner shipping in Taiwan*. Doctorial Dissertation, University of Wales.

Cho, H. & Yang, K. (Eds.). (2011). Identifying country environments to increase container

traffic volumes. *The Asian Journal of Shipping and Logistics*, 27(1), 157-185.

Cho, H. & Kim, Sa. (Eds.). (2015).Examining container port resources and environments to enhance competitiveness: A cross-country study from resource-based and institutional perspectives.*The Asian Journal of Shipping and Logistics*, 31(3), 341-362.

Cho, H. & Ha Y. (Eds.). (2009).Determinants of FDI inflow in regional port with resource-based view and institutional theory: A case of pohang-yeongil port. *The Asian Journal of Shipping and Logistics*, 25(2), 305-333.

Coeck C, Notteboom T, Verbeke A. (Eds.). (1996). A resource-based perspective on strategic port planning. *Proceedings of the International Harbour Congress.* USA, 11, 29-40.

Collison, F. (Ed.). (1984). North to Alaska: marketing in the pacific northwest-central Alaska liner trade. *Maritime Policy and Management*, 11 (2), 99-112.

Conner, K.R. (Ed.). (1991).A historical comparison of resource-based theory and five schools of thought within industrial organization economics: do we have a new theory of the firm?. *Journal of management*, 17(1), 121-154.

Deng, J. (Ed.). (2012). Research on DEA measurement and promotion of port efficiency in China: a perspective based on dynamic comparative advantage enhancement. Doctorial Dissertation, Zhejiang University.

Deng, J. (Ed.). (2011).Analysis and Empirical Study of port efficiency based on function evolution . *Journal of Hebei University (Philosophy and Social Science)*, 36(06), 100-105.

Dong, D. & Zhen, H. (Eds.). (2008). The concept and content of the 4th generation port. Water Transportation Management, (01), 15-17.

Dong, G. (Ed.). (2011).*Research on theory and application of modern port competitiveness*. Doctorial Dissertation, Fu Dan University.

Dooms, M & Macharis, C. (Eds.). (2003) A framework for sustainable port planning in inland ports: a multistakeholder approach. The 43rd European Congress of the Regional Science Association (ERSA) University of Jyväskylä, Finland, 27- 30. August.

Fan, G., Wang, X.L., & Zhang, L.W.(2001).China's market-oriented indexes-a report on the relative process of regional marketization (2000), *Economic Research Journal*,(03),17-27.

Fang, J. & Wen, Z.L. (Eds.). (2015).Analys is of moderating effect based on multiple regression. *Psychological science*, 38 (3), 715-720

Fang, J. X. (Ed.). (2007). Ownership, institutional environment and allocation of credit funds. *Economic Research*, (12), 82-92.

Fang, J. X. (Ed.). (2006). Improvement of marketization process and capital allocation efficiency. Economic Research, (05), 50-61.

Feng, Z.X. (Ed.). (2014).China's Strategic artery extending to Eurasia. *Frontiers*, (04), 79-85.

Feng, J. (Ed.). (2015). Orientation and development strategy of Qinzhou City in Guangxi under the background of "One Belt and One Road. *Around Southeast Asia*, (16), 32-35.

Ferrari, C., Parola, F., & Morchio, E. (Eds.). (2006).Southern European ports and the spatial

distrubution of EDSs. *Maritime Economics&Logistics*, 8, 60-81.

Fiol, C. M. (Ed.). (1991).Managing culture as a competitive resource: An identity-based view of sustainable competitive advantage. *Journal of management*, 17(1), 191-211.

Fleming, D.K. & Baird, A.J. (Eds.). (1999).Some reflections on port competition in the United States and Europe. *Maritime Policy and Management* , 26 (4),383-94.

Fleming, & Douglas K. (Eds.). (1997). World container port rankings. *Maritime Policy and Management* , 24.2: 175-181.

Foster, A.T. (Ed.). (1978).What shippers should look for. *Distribution Worldwide*, 41-44.

Frankel, E. G. (Ed.). (1989). Strategic planning applied to ships and ports. *Maritime Policy and Management*, 16 (2), 123-132.

Franc, P. & Van der Horst, M. R. (Eds.). (2008). Analyzing hinterland service integration by shipping lines and terminal operators in the Hamburg-Le Havre range. *Proceedings of the Annual Conference of the Association of American Geographers*, USA. 12, 289-301.

Galbreath, J. & Galvin, P. (Eds.). (2006). Accounting for performance variation: how important are intangible resources?. *International Journal of Organizational Analysis*, 14(2), 150-170.

Gao, G. Y.，Murray, J. Y.，Kotabe, M., & Lu, J. (Eds.). (2010).A "Strategy Tripod" perspective on export behaviors: Evidence from domestic and foreign firms based in a emerging economy.*Journal of International Business Studies*, 41 (3), 377-396.

Ge, Q.J. & Xiao, H.J. (Eds.). (2007). Review of resource-based competitive strategy theory.*Research on Financial and Economic Issues*, (04), 19-24.

Ghemawat, P. (Ed.). (2001).Distance still matters：The hard reality of global expansion. *Harvard Business Review*，79 (8), 137-147.

Gordon, J. R. M., Lee, P. M., & Jr, H. C. L. (Eds.). (2005).A resource-based view of competitive advantage at the port of Singapore.*Journal of Strategic Information Systems*, 14(1),69-86.

Grant, R.M. (Ed.). (1991).The resource-based theory of competitive advantage: implications for strategy formulation.*California Management Review*, 33(3), 114-135.

Guo, Y., Hu, M.Q., Wang, J.Y., & Liu, Y.F. (Eds.). (2009). *The New Institutional Perspective in Organization and Strategic Management: Theoretical Review and Chinese Examples*. Shanghai: People's Publishing House.

Guo, X.C. & Liu, Q.Z. (Eds.). (2002). Port economy after entering WTO. *Port Economy*, (01), 13-15.

Guo, X.Q. & Huang, J.S. (Eds.). (2015). Comparative analysis on the competitiveness of Xiamen Port and China's main ports. *Navigation of China*, 38(04), 121-124.

Guo, X.D. (Eds.). (2009). A study on the port economic port of modern city development. *Dongyue thesis*, (20), 60-64.

Hao, J., Qi, Y., Wang, D.C., Yang, Y., Li, R., Sun, L., & Y.H. (Eds.). (2015).Environment and

adaptability analysis of coastal port development.*Port & Waterway Engineering*, (06), 70-74.

Ha, M.S. (Ed.). (2003).A comparison of service quality at major container ports: implications for Korean ports.*Journal of Transport Geography*, 11,131-137.

Ha, M. S. (Ed.). (2001).A study on the evaluation on service quality of major container ports in North-East Asian region and their cooperative scheme. *Korea International Commerce Review* , 16(1), 143-171.

Haezendonck, E. (Ed.). (2000). The competitive advantage of seaports. *International journal of maritime economics,* 22 (5), 69-82.

Haezendonck, E. (Ed.). (2001). Essays on strategy analysis for seaports. *Garant*.

Hamel, G. & Prahalad, C. K. (Eds.). (1990). Strategic intent. *Harvard Business Review*, 68(3), 18-38.

Haynes, K. E., Hsing, Y. M., & Tough, R. R. (Eds.). (1997).Regional port dynamics in the global economy:The case of Kaohsiung,TaiWan.*Matitime Policy&Management*, 24(2), 93-113.

He, Z.D. (Ed.). (2010). *Financial Analysis Practice under the New Accounting Standards and Financial Principles*. Guangzhou: Guangdong Economic Publishing House.

Hoare, A. G. (Ed.). (1978).British ports and their export hinterlands a rapidly changing geography.*Geografiska Annaler*, 68(8), 29-40.

Hou, J. (Ed.). (2010).Sustainable development of port economy based on system dynamics. *Systems Engineering-Theory & Practice*, (01), 56-61.

Hu, T.Z. & Huang, L.J. (Eds.). (2007), Measurement of science and technology competitiveness of large and medium-sized industrial enterprises based on super-efficiency DEA method. *Science & Technology Progress and Policy*, 24(05), 56-58.

Huang, W.C., Chen, K.L., & Chien, C.W. (Eds.). (1997).Evaluation indices of Port Transportation System. *Proceedings of 12th Academic Seminar.* China, 12, 495-510.

Huang, Q.M. (Ed.). (2009). Analysis on the competitiveness of Xiamen Port. *China Statistics*, (12), 21-22.

Huang, X. & Cheng, L.L. (Eds.). (2005). Comments on western resource-based theory. *Finance & Economics*, (03), 94-99.

Huang, H., Mo, D.X., & Cheng, W.J. (Eds.). (2017). Evaluation of green port competitiveness based on ANP mode. *Technology Economics*, 36(02), 117-122.

Huang, S.B. (Ed.). (2015).The opportunity and challenge of the development of logistics industry in Guangxi under the background of "One Belt and One Road" strategy. *Technological Development of Enterprise*, (07), 117-119.

Huybrechts, M., Meersman, H., & Van de Voorde, E. (Eds.). (2002). Port competitiveness: An economic and legal analysis of the factors determining the competitiveness of seaports.

Hummels，D. (Ed.). (2007). Transportation costs and international trade in the second era of globalization. *Journal of Economic Perspectives*, 21(3), 131 - 154.

Jeffrey, M. (Ed.). (2015). *Woolddridge Introductory Economics A Modern Approach*.Beijing：Renmin University of China press.

Jiang, C.Y. & Zhao, S.M. (Eds.). (2010).Regional differences in corporate entrepreneurship system environment: an empirical study of Enterprises in 15 national high-tech industrial development zones. *Economic Science*, (06), 53-56.

Jin, P. (Ed.). (2003). Theories and methods for measuring enterprise competitiveness. *China Industrial Economy*, (03), 5-13.

Jing, B. (Ed.). (2003). The theory and method of enterprise competitiveness evaluation. *China Industrial Economics*, (03), 5-13.

Jing, X.R., Ru, Y.C., & Wu, H. (Eds.). (2008). System, Enterprise production efficiency and Regional Export difference in China. *Management World*, (11), 65-77.

Jose, T.Z. (Ed.). (2001).Efficiency measurement of selected Australia and other international ports using data envelopment analysis.*Transportation Research Part A*, 35(4), 107-122.

Jose, T.Z. & Wu, H. (Eds.). (2005).Port privatization efficiency and competitiveness:some empirical evidence from containmer ports(terminals).*Transportation Research:Part A*,39(5)，405-424.

Kenyon, J. (Ed.). (1970). Elements in interport competition in the United States.*Economic Geography*， 46(4),1 - 24.

Kim, M. & Sachish, A. (Eds.). (1986). The structure of production, technical change and productivity in a port. *Journal of Industrial conomies*, 35(2), 209-223.

Kuang, H.B. (Ed.). (2007). *A Study on The Measurement of Port efficiency in China*. Doctorial Dissertation, Dalian University of Technology.

Kuang, H.B. & Cheng, S.W. (Eds.). (2007).Research and demonstration of port comprehensive competitiveness evaluation model based on entropy weight TOPSIS. *Science of Science and Management of S.& T,* (10), 157-162.

Kuang, H.B. (Ed.). (2009). Study on forecasting model of coastal port throughput in China. *Science Research Management*, (03), 187-192.

Lee, P. E., Teo, T. S. H., & Lim, V. K. G. (Eds.). (2000). Information technology management:the case of the port of Singapore Aushority. *Journal of Strategic Information Systems*, 9, 85-99.

Li, Z., Jiang, H.Y., Li, H.L, & Zhang, F.Y. (Eds.). (2009). Competitiveness analysis of inland port based on F-AHP . *Port & Waterway Engineering*, (10), 91-95.

Li, R.P. (Ed.). (2016).Comparative study on the competitiveness of main ports between China and Singapore from the perspective of international trade. *Reformation & Strategy*, (12), 163-166.

Li, C. (Ed.). (2017). *Evaluation of container port competitiveness around Bohai Sea*. Master Thesis ,Dalian Maritime University.

Li, X.Z. (Ed.). (2017). *Study on comprehensive competitiveness of main ports in China*.

Master Thesis , Guangdong University of Foreign Studies.

Li, D. & Cui, R.M. (Eds.). (2015). "One Belt and One Road" strategy and reconstruction of global economic and trade pattern. *Economist*, (08), 62-70.

Li, W.T., Cui, J.K., & Xiang, J. (Eds.). (2018). Countermeasures and fiscal support policies of Guangxi port economy development under the background of "One Belt and One Road" Strategy. *Review of Economic Research*, (17), 48-50.

Li, X.W. (Ed.). (2016). Present situation and countermeasures of modern logistics industry in guangxi under the strategy of "Belt and Road". *Journal of Liuzhou Vocational & Technical College*, (03), 17-23.

Liang, J. & Lv, J. (Eds.). (2010), Analysis on the Development Environment of Shandong Coastal Port [J], Special Zone Economy, (11), 77-79.

Liao, D.S. & Long, L.T. (Eds.). (2017),. Study on the development of Guangxi's open economy under the background of "The belt and road" Strategy. *Reformation & Strategy*, (13), 95-102.

Lin, L.C. & Tseng, C.C. (Eds.). (2007).Operational performance evaluation of major container ports in the Asia-Pacific region, *Maritime Policy and Management*, 34 (6), 535-51.

Lirn, T. C., Thanopoulou, H.A., & Beresford, A. K. C. (Eds.). (2003), Transshipment port selection and decision-making behavior: analyzing the Taiwanese case.*International Journal of Logistics*, 6 (4), 229-44.

Lirn, T. C., Thanopoulou, H. A., Beynon, M. J., & Beresford, A. K. C. (Eds.). (2004), An application of ahp on transhipment port selection: A global perspective, *Maritime Economics and Logistics* 6,70-91.

Liu, F.W., Cun, Z., & Li, Z.Q. (Eds.). (2007). Government intervention, industry competition and salary contract: empirical evidence from state-owned listed companies. *Management World*, (09), 76-84, 128.

Liu, W. (Ed.). (2006). A Study on the Competitiveness of Shanghai International Container Port. Master Thesis ,Dalian Maritime University.

Liu, T., Zhang, G.X., & Huo, J.J. (Eds.). (2013), Spatio-temporal difference analysis of technical efficiency of main ports around Bohai Sea in China, .*Technology Economics*, 32(08), 75-81.

Liu, D.R. (Ed.). (1994). Evaluation model of port efficiency based on multi-index system. *Journal of Shanghai Maritime University*, (02), 1-8.

Liu, K. (Ed.). (2017). International passage for ASEAN. *Guang Ming Daily*, (001).

Liu J.W. (Ed.). (2015). Construction of Guangxi Beibu Gulf international cruise port docking "Belt and Road" strategy. *Border land Studies of China*, (01), 50-63.

Long, W. (Ed.). (2017). Beibu Gulf Port: from "going out" to "melting in". *Chinese Waterway Newspaper*, (005).

Luo, J.H., Cui, E.Y., &, Ji, J.H. (Eds.). (2013). Study on efficiency and influencing factors of

container port based on DEA-TOBIT two-stage method. *Science and Technology Management Research*, 33(05), 236-239.

Lv, L., Gao, H., & Jia, H.Y. (Eds.). (2010). Evaluation of port competitiveness based on factor analysis and data envelopment analysis. *Journal of Dalian Maritime University*, 34(04), 43-47.

Ma, Y.G. (Ed.). (2007). Research on port logistics competitiveness based on FCE-AHP. *Business Management Journal*, (22), 78-83.

Malchow, M. B. & Kanafani, A. (Eds.). (2004), A disaggregate analysis of port selection. *Transportation Research, Part E*, 40(4), 317-337.

Martinez-Budria, E. & Diaz-Armas, R. (Eds.). (1999).A study of the efficiency of Spanish port authorities using data envelopment analysis. *International Journal of Transport Economics*, 26(2), 237-253.

Matthew, M. & Kanafani. A. (Eds.). (2001).A disaggregate analysis of factors influencing port selection. *Maritime Policy & Management*, 28(3), 265-277.

Mayer, H. M. (Ed.). (1957).The port of Chicago and the St. Lawrence seaway.*Development of geography research*,49(3), 30 - 34.

Mayer, H. M. (Ed.). (1978).Current trends in Great Lakes shipping. *Geo Journal*, 28(2), 117 - 122.

Meng, L.K. (Ed.). (2015). An analysis of pakistan's strategic position and its realization path from the perspective of "Belt and Road". *Forum of World Economics & Politics*, (04), 29-45.

Möller, K. & Svahn, S. (2003).Managing strategic nets: A capability perspective. *Marketing theory*, 3(2), 209-234.

Ng, A. K. Y. (Ed.). (2006). Assessing the attractiveness of ports in the North European container transshipment market: an agenda for future research in port competition. *Maritime Economics and Logistics*, 8(3), 234-41.

North, D. C. (Ed.). (1990).*Institutions ， Institutional Change ， and Economic Performance*.Cambridge: Cambridge University Press.

Notteboom, T., Coeck, C., & Van Den Broeck, J. (Eds.). (2000).Measuring and explaining the relative efficiency of container terminals by means of Bayesian Stochastic Frontier Models.*International Journal of Maritime Economics*,24(2),83-106.

Notteboom, T. & Wei, Y. Y. (Eds.). (2012).Port competition and competitiveness. *The Blackwell Companion to Maritime Economics*, 6,549-570.

Notteboom, T. E., Coeck, C., & Verbeke, A. (Eds.). (1997). Containerization and the competitive potential of upstream urban ports in Europe.

Oliver, C. (Ed.). (1997).Sustainable Competitive Advantage Combining institutional and Resource Based Views. Strategic Management Journal,(18),697-713.

Pan, J., Yang, S., & Shen, F.Y. (Eds.). (2012). Modeling and Simulation of Port and City Coupling system based on system Dynamics: a case study of Lianyungang. Systems

Engineering-Theory & Practice, (11), 2439-2446.

Pang, R.Z. (Ed.). (2006). Dynamic efficiency evaluation of main coastal ports in China. *Economic Research Journal*, (06), 92-100.

Pearson, R. (Ed.). (1980). Container Line Performance and Service Quality, *Marine Transport Centre*, Liverpool: University of Liverpool.

Peng, M., Sun, S., Pinkham, B., & Chen, H. (Eds.). (2009).The Institution-Based View as a Third Leg for a Strategy Tripod.*Academy of Management Perspectives,* 23(3),63-81

Penrose, E. T. (Ed.). (1959).*The Theory of the Growth of the Firm*.New York: John Wiley.

Peters, H. (Ed.). (1990). Structural changes in international trade and transport markets: the importance of markets.*The 2nd KMI International Symposium 1990*: 58–75.

Porter, M.E. (Ed.). (1990). *The Competitive Advantage of Nations*. New York: Free Press.

Prahalad, C.K. & Hamel, G. (Eds.). (1990).The core competence of the corporation. *Harvard Business Review*, 23(14), 214-258

Qin, S.T. (Ed.). (2016). International port construction and development in Guangxi under "The belt and road" strategy -- take Qinzhou port as an example. *Reform & Openning*, (13), 26-27.

Qu, L.L., Xu, X., Zhang, F.R., & Xiao, Q.S. (Eds.). (2014). Comprehensive competitiveness evaluation of regional port group based on multi-level factor analysis. *Resource Development & Market*, 30(11), 1308-1311.

Ren, C.Y. (Ed.). (2011). Competitiveness and efficiency analysis of the port of Liaoning Coastal Economic Zone - based on the method PCA and DEA.*Resource Development & Market*, 27(11), 1010-1012.

Robinson, R. (Ed.). (2002).Ports as elements in value-driven chain system: The new paradigm, *Maritime Policy & Management*, 29,241-255.

Roll, Y. & Hayuth, Y. (Eds.). (1993).Port performance comparison applying data Envelopment (DEA). *Maritime Policy and Management*, 20,153-161.

Rugman, A.M. & Verbeke, A. (Eds.). (2004).A perspective on regional and global strategies of multinational enterprises. *Journal of International Business Studies*, (35):3-18.

Ryszard, K., Miler, B. P., Werner, G., & Breslin, J. (Eds.). (2014).Feasibility study on the logistic competitiveness of commercial seaports in Southern Baltic Sea region. *Economic Alternatives*, 4, 22-34.

Sachish, A. (Ed.). (1996). Productivity function as a managerial tool in Israeli-ports. *Maritime Policy and Management*，23(4),341-369.

Selznick, P. (Ed.). (1957). *Leadership in Administration: A Sociological Interpretation, Row, Peterson and Company*. New York: Free Press.

Scott, W. R. (Ed.). (1995).*Institutions and Organizations*.Thousand Oaks，CA：Sage Publications，Inc.

Scott, W. R. (Ed.). (2001). *Institutions and Organizations (Second Edition)*.California: Sage Publications, Inc.

Scott ,W. R. (Ed.). (2008). *Institutions and Organizations: Ideas and interests (Third Edition)*. California: Sage Publications, Inc.

Shen, J.S. & Yu, W. (Eds.). (2014). A study on the economic efficiency of major ports in Bohai Region . *East China Economic Management*, (10), 72-76.

Si, Z.Z. (Ed.). (2012). Study on the correlation between port city infrastructure and regional economic agglomeration: comparison between Lianyungang city and Rizhao city. *Reform of Economic System*, (1), 70-74.

Si, Z.Z. (Ed.). (2015). Interactive development of port infrastructure and port city economy. *Management Review*, (11), 33-43.

Song, L., Wang, X.X., & Lin, X.W. (Eds.). (2007). Port economic accounting program design. *Statistical Research*, (10), 86-88.

Sun, J.T. & Shao, W.H. (Eds.). (2009). On the improvement of economic competitiveness of port. *Dongyue Tribune*, (2), 57-59.

Sun, Q.G. (Ed.). (2006). On comptence enhancement of Zhejiang′s five main seaports through resource allocation . *Port & Waterway Engineering*, (8), 21-25.

Sun, Q.G. & Pan, G.Q. (Eds.). (2007). Competitiveness of seaports in Zhejiang Province. *Journal of Shanghai Maritime University*, (3), 75-80.

Sun R., Wang, Z.Y., & Guo, M.Y. (Eds.). (2013). Comprehensive Evaluation Research on Competitiveness of Ports in Chinese Coastal Areas. *Resource Development & Market*, 29(08), 809-813.

Sun, Z.L., Lu, Y.Q., & Huang, S.H. (Eds.). (2012). Prediction of port throughput basedon Markov chain-time series analysis. *Journal of Zhejiang University (Engineering Science)*, 46(07), 1289-1294.

Sun, Z.Y. (Ed.). (2014). Triple connotation of "The belt and road" strategic conception, *China Economic Times*. 8,11.

Sun, G.Q. (Ed.). (2004).The basic definition and function of Dalian's significant shipping center in Northeast Asia. *Journal of Dalian Maritime University(Social Science Edition)*, (1), 15-18.

Song, D.W. & Panayides P.M. (Eds.). (2008).Global supply chain and port/terminal: integration and competitiveness.*Maritime Policy&Management*, 35(1), 73-87.

Song, D. W. & K. Yeo (Eds.). (2004), A competitive analysis of Chinese container ports using the analytic hierarchy process, *Maritime Economics and Logistics*, 34(6), 34-52.

Tai, H., & Hwang C. (Eds.). (2005), Analysis of hub port choice for container trunk lines in East Asia. *Journal of the Eastern Asia Society for Transportation Studies*, 6,907-919.

Talley, W. K. (Ed.). (1994). Performance Indicators and Port Performance Evaluation. *The Logistics and Transportation Review*, 30(6), 339-352.

Tang, L.M., Liu, C.L., & Li, X.F. (Eds.). (2007). Evaluation of container port's competitiveness based on market segmentation. *Journal of Dalian Maritime University (Social Science Edition)*, (6), 116-119.

Tao, J. (Ed.). (2016). Study on the development opportunities and risks of guangxi under "The belt and road" strategy. *Economic & Trade Update*, (33), 58-60.

Teng, J.Y., Huang, W. C., & Huang, M. J. (Eds.). (2004). Multicriteria evaluation for port competitiveness of eight East Asian container ports. *Journal of Marine Science and Technology*, 12(4), 256-264.

Teng, W.C. & Hu, Z.H. (Eds.). (2017). Analysis on the competitiveness of Chinese coastal ports based on the TOPSIS method and DEA method. *Journal of Jiangsu University of Science and Technology (Natural Science Edition)*, 31(04), 537-543.

Tengku, J. & Tengku, M.S. (Eds.). (1995). *Marketing of freight liner shipping services with reference to the far East-Europe trade: a Malaysian perspective*.Doctorial Dissertation, University of Wales.

The Guangxi Zhuang Autonomous Region Statistics Bureau. Qinzhou: basic situation of economic operation in 2016 Retrieved January 26, 2017, from http://www.gxtj.gov.cn/tjxx/jdfx/sx/ 201701/t20170126_129821.html

Tong, Z. (Ed.). (2017). Beibu Gulf: port and industry support "Seaward Economy". *Economic Journal*, 11, 4-7.

Tongzon, J.L. (Ed.). (2001).Efficiency measurement of selected Australian and other international Ports using envelopment analysis.*Transportnation Research (Part A)*, 35: 113-128.

Tu, D.M. (Ed.). (2006). Thinking on the innovation of port management system. *China Ports*, (05), 18-20.

Ugboma, C., Ugboma, O., & Ogwude, I. (Eds.). (2006). An Analytic Hierarchy Process (AHP) approach to port selection decisions-empirical evidence from Nigerian ports. *Maritime Economics and Logistics*, 8 (3), 251-66

Van Hooydonk, E., Verbeke, A., & Winkelmans, W. (Eds.). (2002). "Port competitiveness: an economic and legal analysis of the factors determining the competitiveness of seaports."

Van Hooydonk, E. (2007).*Soft Values of Seaports*. Garand: Antwerp, Belgium,

Valentine, V.F. & Gray, R. (Eds.). (2001). The measurement of port efficiency using Data Envelopment Analysis. *The 9 World Conference on Transport Research*.

Van Klink, H.A. (Ed.). (1998).The port network as a new stage in port development:the case of roterdam.*Environment and Planning*, 30(3),456-471.

Wang, J. & Slack, B. (Eds.). (2000). The evolution of a regional container port system:The Pearl River Delta.*Journal of Transport Geography*, 8(4),263-275.

Wang，H. & Qian, C. (Eds.). (2011).Corporate philanthropy and corporate financial performance：the roles of stakeholder response and political access.*Academy of Management Journal*, 54 (6), 1159-1181.

Wang, Y. G., Jay, A. K., Hing-Po L., & Shi, G.C. (Eds.). (2006). The roles of brand equity and corporate reputation in CRM: A Chinese study. *Corporate Reputation Review*, 9(3), 179-197.

Wang, X. L., Fan, G., & Ma, G. Ro. (Eds.). (2018).2017 report of China's sub-provincial enterprise operating environment index. *Economic Trends*, (04), 2.

Wang, X. L., Fan, G., & Yu, W. J. (Eds.). (2017), Market index report of China's sub-provinces (2016). Peijing: Economic Sciences Press.

Wang, G.C. (Ed.). (2009).Port location value: an analysis of port competitive advantage. *Journal of Guangxi University (Philosophy and Social Science)*, (8), 31-34.

Wang, C.Y., Xiao, P.M., & Xiao, L.N. (Eds.). (2006).Application of fuzzy synthesis evaluation of entropy weight in evaluating port's competitiveness. *Journal of Waterway and Harbor*, 27(2), 131-134.

Wang, W., Wang, C.J., & Jin, F.J. (Eds.). (2018).The classification of transportation functions of China's coastal ports based on cargo structure. *Geographical Research*, (03), 527-538.

Wang, Z.L. & Han, Z.L. (Eds.). (2012). Research on Competitiveness of Main Ports in Circum-Bohai Area. *Resource Development & Market*, 28(03), 214-217.

Wang, L.M. (Ed.). (2018). The empirical research of China ports sustainable competiveness in the transition period-based on malmquist DEA model for dynamic efficiency. *Economic Research Guide*, (6), 175-176, 199.

Wang, R.X. (Ed.). (2008). On the resources integration tactics of our country port— taking the Ningbo—zhoushan port as an example. *Economic Geography*, (5), 872-875.

Wang, F.L., Zhang, X.C., Yang, L.C., & Hong, S.J. (Eds.). (2016). Rescaling and scalar politics in the “One Belt, One Road” strategy. *Scientia Geographica Sinica*, 36(04), 502-511.

Wang, L., Wang N., & Tong, S.Q. (Eds.). (2008). Research on coordinated development degree between port and urban environment and resource -- a case study of Dalian City. *Navigation of China*, (4), 410-414.

Wang, Q.X. (Ed.). (2017). Guangxi has jointly built “The belt and road” to develop “Seaward Economy”. 5, 31. (001).

Wang, J.M. (Ed.). (2017). Study on the development of port group competition in Beibu Gulf under the initiative of “The belt and road”. *Review of Economic Research*, (47), 101-104.

Wei, F. & Liu X.W. (Eds.). (2017).Capital investment efficiency of China's listed companies -- regional comparison, industrial differences and influencing factors. *China Accounting Review*, 15(04), 533-560.

Wei, M.X. & Hu, J.K. (Eds.). (2017). Research on the port comprehensive strength evaluation and operation efficiency analysis based on the entropy-weighted-TOPSIS and DEA method. *Journal of Central China Normal University (Natural Sciences)*, (3), 356-363.

Welgend, G. (Ed.). (1958).Some elements in the study of port geography.*Geographical Review*， 48(2), 185 - 200.

Wen, Z. L., Hou J. t., & Zhang, L. (Eds.). (2005). Comparison and application of regulatory effect and mediating effect. *Journal of Psychology,* 37 (2), 268-274

Wen, X.J. & Liu, H.J. (Eds.). (2007). The theory that strategic management research should follow: resource -based view vs .transaction cost theory. *Journal of Central University of Finance & Economics*, (8), 63-67.

Wen, Z.L., Hau, K.T., & Chang, L. (Eds.). (2005).A comparison of moderator and mediator and their applications .*Acta Psychologica Sinica*,37(02),268-274.

Wernerfelt, B. A. (Ed.). (1984).Resource-Based view of the firm.*Strategic Management Journal*, 5(1), 171-180.

Willingale, M.C. (Ed.). (1981).The port routing behaviour of short sea ship operator theory and practices. *Maritime Policy and Management*, 8 (2), 109-120.

Wu, H., Wang, D.P., Zhang, Q., & Zhang, Z.D. (Eds.). (2015). Evaluation and comparative study on competitiveness of international cruise ports based on cloud model. *China Soft Science*, (2), 166-174.

Xia, L. J. & Fang, Y. Q. (Eds.). (2005). Government control, governance environment and corporate value -- empirical evidence from China's securities market. *Economic Research*, (05), 40-51.

Xie, L.F. & Chen, Y.W. (Eds.). (2012). Discussion on development environment and strategy analysis of coastal port in Guangdong province in new era. *Port & Waterway Engineering*, (05), 1-7.

Xie, X. (Ed.). (2008). Analysis of port competition pattern from the perspective of new economic geography. *China Ports*, (1), 19-21.

Xie, K. (Ed.). (2004). Economic efficiency: the core and essence of Chinese enterprises' international competitiveness -- on the design of enterprise's international competitiveness index system.*World Economy Study*, (11), 4-10.

Xu, Q. (Ed.). (2006). Research on the Zhejiang Province port resource conformity. *Navigation of China*, (3), 68-71, 76.

Xu, Y.S. & Qiao, B.Y. (Eds.). (2012). Measuring degrees of fiscal decentralization: theory and china experience from 1985 to 2007. *Economic Research Journal*, (10), 4-13.

Xu, Y. Q. (Ed.). (2016). *Study on comprehensive strength of coastal ports and spatial evolution of hinterland.* Doctorial Dissertation, Zhejiang university of technology.

Xu, Z.B. & Zhu, Y.Z. (Eds.). (2004). Theoretical analysis of the strategy on port-city's integration. *Journal of Zhanjiang Ocean University*, (5), 7-13.

Yang, S. & Pan, J. (Eds.). (2011). Dynamic simulation and regulation of port-city coupling development: Taking Lianyungang as a case. *Geographical Research*, (6), 1021-1031.

Yang, G. (Ed.). (2011). On economic security principle of harbor in basic principles of the Harbor Law. *Journal of Dalian Maritime University (Social Sciences Edition)*, (03), 81-84.

Yang, L. (Ed.). (2016). Analysis on the construction and development of guangxi border

economic belt under "The belt and road" strategy. *Review of Economic Research*, (65), 74-77.

Yang, W. & Zong, Y.G, (Eds.). (2008). Constructing the relationship of port and city for modern port city--a case of Nantong city in Jiangsu province. *Economic Geography*, (2), 209-213.

Yao, F., Che, Y., & Wu, X.C. (Eds.). (2011). Research on evaluation of port city scale competitiveness based on factor analysis -- taking Rizhao city as an example. *Journal of Shanxi Finance and Economics University*, (32), 5-6.

Yeo, G.T. & Song, D.W. (Eds.). (2006). An application of the hierarchical fuzz process to container port competition: Policy and strategic implications. *Transportation*, 33(4), 409-422.

Yin, W.W. & Mou, D.G. (Eds.). (2011). Analysis of the Ningbo- Zhoushan port hinterland and the meaning to port economy development. *Economic Geography*, (3), 447-452.

Yu, L.S., Yin, X.Y., & Tong, Y.Q. (Eds.). (2011). China cruise ports competitiveness evaluation based on factor analysis method. *Journal of Dalian Maritime University*, (1), 83-86.

Yu, L.Y. (Ed.). (2016). Thinking on development of multi-modal transportation system in Guangxi: "A One Belt One Road Perspective" . *Logistics Technology*, (1), 26-29.

Yu, M.G. & Pan, H.B. (Eds.). (2008). The relationship between politics, institutional environments and private enterprises' access to bank loans. *Management World*, (8), 9-21.

Yu, Y. (Ed.). (2003). Competitiveness analysis and promotion strategy of China's large coastal foreign trade ports. *International Trade Journal*, (06), 15-19.

Yu, Y. (Ed.). (2013). *Port Economic Impact Factor Evaluation – A Case Study of Guangxi Beibu Gulf Port Economy*. Master Thesis, Guangxi University.

Yuan, Q. (Ed.). (2001). A brief analysis of the basic ways to improve the competitiveness of ports. *Port Operation*, (2), 29- 30.

Yuen, C.A., Zhang, A.M., & Cheung, W.M. (Eds.). (2012).Port competitiveness from the user`s perspective: An analysis of major container ports in China and its neighboring countries. *Research on Transportation Economics*, 35(4), 34-40.

Zeng, C.H. (Ed.). (2012). The theoretical research on the relationship between resource and economy and the transformation of resource economy is summarized. *Vocational & Technical Education Forum*, (22), 82-86.

Zeng, F.H. & Ma, J. (Eds.). (2008). Construction of port international transit competitiveness evaluation index system. *Comprehensive Transportation*, (06), 69-71.

Zhang, X.L. & Zhou, S.L. (Eds.). (Eds.). (2012).The interaction between port economy and culture. *China Ports*, (9), 17-20.

Zhang, X.D. & Deng, J. (Eds.). (2013). Study on the efficiency of china's ports and its enhancement. *Journal of Zhejiang University (Humanities and Social Sciences)*, 43(04), 39-51.

Zhang, J. (Ed.). (2014). Advantages and positioning of southwest China in "The belt and road"

opening strategy. *Economic Review*, (11), 93-96.

Zhang, Y.L. (Ed.). (2014). Focus on the "The belt and road" strategy. *New Silk Road Horizon*, (8), 41-42.

Zhang, H. & Wang, D. (Eds.). (2013). The competitiveness of ports is discussed from the perspective of supply chain. *World Shipping*, 36(02), 25-27.

Zhang, Z.L. (Ed.). (2018). Guangxi establishes a new pattern of opening up. *China National News*, 1, 30, (004).

Zhang, Z.H. & Wang, D.R. (Eds.). (2015). Comparative advantages and development approaches of Guangxi in "The belt and road" strategy. *ContemporaryEconomics*, (23), 77-79.

Zhao, W.J. & Shou, J.M. (Eds.). (2015). Competitiveness evaluation of China's major coastal ports based on principal component analysis. *Journal of Development & Reform*, (3), 38-43, 7.

Zhao, N. & Zhen, H. (Eds.). (2015). Post-assessment of port resource integration effectiveness based on malmquist index and attribute theory. *Journal of Transportation Systems Engineering and Information Technology*, (3), 214-221.

Zhao, N. & Zhen, H. (Eds.). (2016). Port niche resource integration decision-making mechanism based on multi-objective integer programming model. *Systems Engineering*, (1), 122-126.

Zhao, T.R., Sun, C.W. & Zhang, F.G. (Eds.). (2015). Opportunities and challenges of r egional economic development under the background of "The belt and road". *On Economic Problems*, (12), 19-23.

Zhao, P.J. & Lv, B. (Eds.). (2005). Port economy and its spatial effects: A case study on Rotterdam Port, Netherlands. *Human Geography*, (5), 108-111.

Zheng, H. (Ed.). (2008). Study on the evolution of port competitiveness in China. *Statistics and Decision*, (18), 59-60.

Zheng, S.Y. (Ed.). (2014). Analysis of port efficiency and productivity in China based on input distance function method. *Lanzhou Academic Journal*, (06), 125-130.

Zhu, C.G., Liu, B., & Li, Z.J. (Eds.). (2009). Study on the relationship between port and hinterland and the driving factors -- a case study of lianyungang port and huaihai economic zone. *Geographical Research*, 28(03), 716-725.

Zhou, L.P. & Di, Q.B. (Eds.). (2011). Qingdao Port competitiveness analysis in Bohai-linking Region .*Resource Development & Market*, 27(09), 793-796, 848.

Zhou, Y.K. (Ed.). (2017). *Port competitiveness analysis of Bohai rim region based on "The belt and road" strategy*. Master thesis, Dalian Maritime University.

Zhou, P.B. (Ed.). (2003). The analysis on the port industry effect caused by different market structure. *Journal of Shanghai Maritime University*, (04), 330-333, 339.

Zhu, Q.L. & Guo, P.F. (Eds.). (2005). Theory and application of quantitive evaluation of port resources . *Journal of Dalian Maritime University*, a (4), 44-48.

Zhu, Q.L. & Guo, P.F. (Eds.). (2005). An entropy-based evaluation model for multiple objective decisions making in port resources. *Journal of Shandong Agricultural University (Natural Science)*, b (2), 258-265.

Zhu, P.Y. (Ed.). (2017), Enhancing strategy of efficiency of Fujian port enterprises based on “The Belt and Road Initiative”. China Soft Science Research Institute, *Proceedings of the 13th China Soft Science Academic Conference* .China, 7, 1365-1378

Zou, Y.J. & Xi, X.Y. (Eds.). (1998). Comparison and analysis of competitiveness between Shanghai port and surrounding ports. *China Water Transport*, (07), 9-12.

Webliography

The Guangxi Zhuang Autonomous Region Statistics Bureau. Qinzhou: basic situation of economic operation in 2016 Retrieved January 26, 2017, from http://www.gxtj.gov.cn/tjxx/jdfx/sx/ 201701/t20170126_129821.html

Appendix A：Original data of 13 port competitiveness evaluation indicators

Year	No.	port	container throughput (TEU)	throughput capacity(100 million tons)	The number of berths	shoreline length
	1	Beibu Gulf Port	34.87	0.94	217.00	2.31
	2	Shanghai Port	2500.23	5.92	614.00	7.23
	3	Ningbo Port	1050.33	5.77	628.00	6.46
	4	Tianjin Port	870.35	3.80	124.00	2.67
	5	Tangshan Port	24.00	1.50	44.00	1.09
	6	Dalian Port	457.65	2.72	196.00	3.33
2010	7	Yingkou Port	353.73	1.76	50.00	1.12
	8	Yantian Port	1825.01	1.94	156.00	0.62
	9	RIZHAO Port	82.09	1.81	44.00	1.09
	10	Xianmen Port	468.19	1.19	101.00	2.05
	11	Zhuhai Port	56.39	0.44	118.00	1.24
	12	Lianyungang Port	303.18	1.14	53.00	1.05
	13	Nanjing Port	105.85	0.60	257.00	2.71
	1	Beibu Gulf Port	56.40	1.19	227.00	2.47
	2	Shanghai Port	2906.90	6.50	602.00	7.25
	3	Ningbo Port	1314.70	6.33	650.00	7.17
	4	Tianjin Port	1008.60	4.13	140.00	3.06
	5	Tangshan Port	27.70	2.47	44.00	1.34
	6	Dalian Port	526.30	3.14	200.00	3.37
2011	7	Yingkou Port	333.80	2.25	63.00	1.32
	8	Yantian Port	2251.00	2.20	160.00	0.63
	9	RIZHAO Port	106.00	2.26	47.00	1.16
	10	Xianmen Port	583.43	1.39	144.00	2.32
	11	Zhuhai Port	70.30	0.61	122.00	1.29
	12	Lianyungang Port	387.00	1.34	53.00	1.02
	13	Nanjing Port	145.30	1.58	319.00	2.90
2012	1	Beibu Gulf Port	73.80	1.53	708.00	2.71

	2	Shanghai Port	3173.93	6.24	606.00	7.27
	3	Ningbo Port	1471.92	6.94	625.00	7.38
	4	Tianjin Port	1158.76	4.53	143.00	3.14
	5	Tangshan Port	34.10	3.13	53.00	1.66
	6	Dalian Port	640.00	3.37	198.00	3.40
	7	Yingkou Port	403.40	2.61	69.00	1.47
	8	Yantian Port	2257.08	2.23	156.00	0.63
	9	RIZHAO Port	139.95	2.53	48.00	1.20
	10	Xianmen Port	646.50	1.57	142.00	2.54
	11	Zhuhai Port	81.50	0.72	125.00	1.35
	12	Lianyungang Port	485.19	1.66	53.00	1.02
	13	Nanjing Port	184.24	1.89	327.00	3.03
	1	Beibu Gulf Port	82.43	1.74	241.00	3.06
	2	Shanghai Port	3252.94	7.35	612.00	7.45
	3	Ningbo Port	1617.48	7.44	601.00	7.57
	4	Tianjin Port	1230.31	3.74	148.00	3.26
	5	Tangshan Port	345.50	3.64	63.00	2.04
	6	Dalian Port	806.43	3.74	206.00	3.69
2013	7	Yingkou Port	485.10	3.00	75.00	1.62
	8	Yantian Port	2294.13	2.28	152.00	0.63
	9	RIZHAO Port	174.92	2.81	52.00	1.30
	10	Xianmen Port	720.17	1.72	139.00	2.56
	11	Zhuhai Port	81.28	0.77	129.00	1.70
	12	Lianyungang Port	502.01	1.85	56.00	1.12
	13	Nanjing Port	230.03	2.07	334.00	3.17
	1	Beibu Gulf Port	100.00	1.87	249.00	3.09
	2	Shanghai Port	3362.00	7.76	608.00	7.45
	3	Ningbo Port	1735.00	8.10	613.00	7.84
	4	Tianjin Port	1300.00	4.07	149.00	3.44
2014	5	Tangshan Port	72.80	4.46	77.00	2.37
	6	Dalian Port	1001.00	4.07	212.00	3.81
	7	Yingkou Port	530.00	3.20	76.00	1.64
	8	Yantian Port	2328.00	2.00	150.00	0.63

	9	RIZHAO Port	202.00	3.09	50.00	1.27
	10	Xianmen Port	800.00	1.90	143.00	2.56
	11	Zhuhai Port	88.00	1.00	153.00	1.70
	12	Lianyungang Port	548.00	2.02	51.00	1.17
	13	Nanjing Port	267.00	2.11	337.00	3.25
	1	Beibu Gulf Port	112.00	2.02	256.00	3.35
	2	Shanghai Port	3528.50	4.23	608.00	7.51
	3	Ningbo Port	1945.00	8.73	615.00	8.01
	4	Tianjin Port	1405.00	4.23	151.00	3.46
	5	Tangshan Port	110.90	4.23	217.00	2.61
	6	Dalian Port	1012.76	4.23	215.00	3.87
2015	7	Yingkou Port	576.82	4.23	80.00	1.74
	8	Yantian Port	2403.00	2.36	144.00	0.63
	9	RIZHAO Port	242.00	2.10	51.00	1.32
	10	Xianmen Port	857.24	2.05	154.00	2.83
	11	Zhuhai Port	105.00	2.36	144.00	1.73
	12	Lianyungang Port	500.54	2.10	60.00	1.44
	13	Nanjing Port	276.00	2.20	352.00	3.25
	1	Beibu Gulf Port	141.50	2.05	260.00	3.53
	2	Shanghai Port	3654.00	5.10	609.00	7.52
	3	Ningbo Port	2063.00	8.89	624.00	8.30
	4	Tianjin Port	1411.00	5.40	157.00	3.65
	5	Tangshan Port	152.20	4.93	97.00	2.82
	6	Dalian Port	945.00	4.50	222.00	4.01
2016	7	Yingkou Port	592.25	3.38	83.00	1.82
	8	Yantian Port	2420.00	2.17	153.00	0.76
	9	RIZHAO Port	281.14	3.37	53.00	1.37
	10	Xianmen Port	918.00	2.10	155.00	2.92
	11	Zhuhai Port	133.77	1.12	147.00	1.84
	12	Lianyungang Port	500.92	2.11	62.00	1.53
	13	Nanjing Port	294.00	2.22	68.00	3.12

Appendix B：Competitiveness evaluation results of 13 ports

Table B-1Constant Returns to Scale Technical Efficient (CRSTE)and ranking of 13 ports

Order	Port Name	2010	2011	2012	2013	2014	2015	2016	Mean	Ranking
1	Beibu Gulf Port	0.200	0.208	0.159	0.233	0.234	0.228	0.228	0.213	13
2	Shanghai Port	0.433	0.448	0.444	0.437	0.451	0.363	0.413	0.427	9
3	Ningbo Port	0.434	0.382	0.389	0.402	0.401	0.411	0.420	0.406	10
4	Tianjin Port	0.931	0.898	0.939	0.758	0.763	0.792	0.866	0.850	6
5	Tangshan Port	0.829	1.000	1.000	1.000	0.937	0.601	0.799	0.881	4
6	Dalian Port	0.457	0.447	0.445	0.465	0.484	0.469	0.455	0.460	7
7	Yingkou Port	1.000	0.902	0.918	0.897	0.885	1.000	0.839	0.920	3
8	Yantian Port	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1
9	Rizhao Port	1.000	1.000	1.000	1.000	1.000	0.779	1.000	0.968	2
10	Xiamen Port	0.494	0.386	0.420	0.431	0.446	0.431	0.468	0.439	8
11	Zhuhai Port	0.174	0.202	0.216	0.187	0.224	0.505	0.238	0.249	12
12	Lianyun Port	0.709	0.831	0.990	0.887	1.000	0.832	0.813	0.866	5
13	Nanjing Port	0.109	0.222	0.242	0.248	0.243	0.235	0.598	0.271	11

TableB-2 Variable Returns Scale Technical Efficiency (VRSTE)and ranking of 13 ports

Order	Port Name	2010	2011	2012	2013	2014	2015	2016	Mean	Ranking
1	Beibu Gulf Port	0.395	0.368	0.232	0.328	0.326	0.324	0.331	0.329	13
2	Shanghai Port	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1
3	Ningbo Port	1.000	0.969	1.000	1.000	1.000	1.000	1.000	0.996	6
4	Tianjin Port	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1
5	Tangshan Port	1.000	1.000	1.000	1.000	1.000	0.867	1.000	0.952	7
6	Dalian Port	0.512	0.573	0.557	0.612	0.663	0.587	0.655	0.594	10
7	Yingkou Port	1.000	0.926	0.921	0.899	0.954	1.000	0.857	0.937	8
8	Yantian Port	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1
9	Rizhao Port	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1
10	Xiamen Port	0.577	0.446	0.439	0.487	0.455	0.492	0.528	0.489	11
11	Zhuhai Port	0.734	0.699	0.669	0.596	0.571	0.624	0.619	0.645	9
12	Lianyun Port	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1
13	Nanjing Port	0.336	0.299	0.286	0.290	0.286	0.290	0.787	0.368	12

Note: Shanghai port, Tianjin port, Yantian port, Rizhao Port and Lianyun Port are tied for the first place.

TableB-3 Scale Efficiency (SE), Type of Return to Scale(TRS)and ranking of 13 ports

Order	Port Name	2010		2011		2012		2013		2014		2015		2016		Mean	Ranking
		SE	TRS	SE	TRS	SE	TRS	SE	TRS	SE	TRS	SE	TRS	SE	TRS		
1	Beibu Gulf Port	0.39	0.36	0.23	0.32	0.32	0.32	0.33	0.32	13	IRS	0.70	IRS	0.68	IRS	0.65	10
2	Shanghai Port	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1	DRS	0.36	DRS	0.413	DRS	0.427	11
3	Ningbo Port	1.00	0.96	1.00	1.00	1.00	1.00	1.00	0.99	6	DRS	0.411	DRS	0.420	DRS	0.407	12
4	Tianjin Port	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1	DRS	0.792	DRS	0.866	DRS	0.850	7
5	Tangshan Port	1.00	1.00	1.00	1.00	1.00	0.86	1.00	0.95	7	DRS	0.901	DRS	0.799	DRS	0.924	4
6	Dalian Port	0.51	0.57	0.55	0.61	0.66	0.58	0.65	0.59	10	DRS	0.799	DRS	0.695	DRS	0.779	8
7	Yingkou Port	1.00	0.92	0.92	0.89	0.95	1.00	0.85	0.93	8	DRS	1.000	CRS	0.979	DRS	0.982	2
8	Yantian Port	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1	CRS	1.000	CRS	1.000	CRS	1.000	1
9	Rizhao Port	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1	CRS	0.779	IRS	1.000	CRS	0.968	3
10	Xiamen Port	0.57	0.44	0.43	0.48	0.45	0.49	0.52	0.48	11	IRS	0.876	IRS	0.886	IRS	0.901	5
11	Zhuhai Port	0.73	0.69	0.66	0.59	0.57	0.62	0.61	0.64	9	IRS	0.810	IRS	0.384	IRS	0.393	13
12	Lianyun Port	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1	IRS	0.832	IRS	0.813	IRS	0.866	6
13	Nanjing Port	0.33	0.29	0.28	0.29	0.28	0.29	0.78	0.36	12	IRS	0.811	IRS	0.760	IRS	0.741	9

Note: return to scale can be divided into three categories: constant returns to scale (CRS), decreasing returns to scale (DRS) and increasing returns to scale (IRS).

Appendix C：Questionnaire

Dear Experts：

Thank you very much for participating in this questionnaire. We designed this questionnaire in order to understand and research on the competitiveness of Beibu Gulf port. In strict accordance with the laws of statistics, you can fill out this questionnaire anonymously. Your answer is only for research and will be strictly reserved. There is no right or wrong answer, thus please fill in this questionnaire truthfully. Thank you very much!

No.：

A1、Interview Outline

Your Position---------- Years of Service in Port Management----

1. What do you think are the main competitors of Beibu Gulf port? Compared with these competitors, what are the advantages and disadvantages of Beibu Gulf port?

2. What are the main factors influencing the competitiveness of Beibu Gulf port?

3. What are the advantages and disadvantages of Beibu Gulf port internal management?

4. What are the supporting or preferential policies of the state and Guangxi autonomous region respectively to promote the development of Beibu Gulf port? What are the current systems that hinder the competitiveness of Beibu Gulf port?

5. According to the actual situation of Beibu Gulf port, what is the relationship between port competitiveness and port throughput?

6. According to the actual situation of Beibu Gulf port, what is more important in terms of port facilities? What is the relationship between port facilities and port competitiveness?

7. According to the actual situation of Beibu Gulf port, what are the important conditions of port connection? What is the relationship between port connectivity conditions and port competitiveness?

8. According to the actual situation of Beibu Gulf port, what is the relationship between the efficiency of port operation and the competitiveness of port? There’s a positive correlation between them.

A2、Questionnaire

1. Determine the impact of various factors on port competitiveness (tick "○"on the suitable item)

Item		Disagree → Agree						
		1	2	3	4	5	6	7
1. Port Location	1a. Geographic Position							
	1b. Natural Factor							
	1c. Hinterland Area							
2. Port Charges	2a. Total Port Charges							
	2b. Various Rates							
3. Port Facilities	3a. Handling Efficiency							
	3b. Storage Space							
	3c. Equipment Dependability							
4. Shipping Service	4a. Dock demand							
	4b.Stop Times							
	4c. Various Shipping Companies							
5. Terminal Operator	5a. Provide ustomer service to users							
	5b. Safety and Accident Handling							
6.Port Information System	6a. Electronic Information Supply							
	6b. Electronic Information Accessibility							
7.Hinterland Connection	7a.Inland Transportation Cost							
	7b.Hinterland Transit Time							
8.Customs and Government Control	8a.Customs Formalities							
	8b. The government regulates administrative procedures							

2. The following hypotheses are used to assess the impact of various conditions on port competitiveness. Please specify the level of matching or divergence that is consistent with your actual situation**(**tick "○"on the suitable item**)**

Item	Strongly Disagree	Disagree	Partly Disagree	Partly Agree	Agree	Strongly Agree
Port competitiveness and port throughput are positively correlated						
Port facilities and port competitiveness are positively correlated						
Port connectivity conditions and port competitiveness are positively correlated						
Port operation efficiency and port competitiveness are positively correlated						
The institutional environment positively adjusts the relationship between port competitiveness and port throughput						
The institutional environment is positively regulating the relationship between port facilities and competitiveness						
The institutional environment positively adjusts the relationship between port connection conditions and port competitiveness						
The institutional environment is positively regulating the relationship between the efficiency and competitiveness of port operation						

The interview and questionnaire survey are over. Thank you again for your support and cooperation!

Recorders： Contact Information：