The Growth Trend of the Chinese Construction Industry:

When it will Surpass the U.S. Construction Industry

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Abstract

U.S. architectural, engineering and construction (AEC) firms doing business in China are minimally successful because they are unfamiliar with the Chinese market. To assist the U.S. AEC firms to become more competitive in the Chinese market, a comprehensive investigation of the Chinese construction industry after the Culture Revolution was conducted. The development of the industry was divided into three stages: the first stage from 1978 to 1992, the second stage from 1992 to 2001, and the third stage from 2001 to 2007. In each stage, the administrative framework, laws and regulations, procurement methods, and market structure were studied. In addition, statistical data, such as Gross Domestic Product, Gross Output Value, and the numbers of employees and companies during each stage, were analyzed. Next, economic indicators of the Chinese and U.S. construction industries were compared. Finally, the future growth trend of the Chinese construction industry was projected. The results of the investigation can help the U.S. AEC firms become more familiar with the Chinese construction market and be more competitive in this market.

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Chapter 1

Introduction

1.1 Background

In recent years China has experienced a huge economic growth. According to The World Factbook 2008, measured on purchasing power parity (PPP) that adjusts for price differences, China stood as the second largest economy in the world after the U.S. Measured on official exchange rate, China ($4.222 trillion) has surpassed Germany ($3.818 trillion) on Gross Domestic Product in 2008 and has become the third largest economy after the U.S. and Japan. As an important segment of the national economy, the construction industry also increased greatly. From 2001 to 2007 the Gross Output Value of the Chinese construction industry had an average growth rate of 22.3% (China Statistical Yearbook 2008). After its entry to the World Trade Organization (WTO) in 2001, China has built many landmark buildings. The Shanghai World Financial Center completed in 2008 currently is the second tallest building in the world; and the Beijing Capital International Airport Terminal 3, fully operational in 2008, is currently the second largest airport passenger terminal building of the world. Built for the 2008 Beijing Olympics, the Beijing National Stadium (the Bird's Nest) and the Beijing National Aquatics Center (the Water Cube) have attracted

the world' s attention. The Chinese construction market was the third largest in the world in 2002, with a total construction value of $404 billion dollars (Shen, Zhao and Drew 2003). In 2008 the global construction market continued to boom and the Chinese construction industry was also expanding.

Like China's construction industry, Chinese construction firms were growing fast in recent years. In 2001 there were 45,893 construction firms in China, including state owned, collective owned, other types of domestic funded and foreign funded firms (China Statistical Yearbook 2008). In 2007 the number has increased by 35.26%, to 62,074 construction firms. Additionally, the workers employed by Chinese construction firms increased by 48.47% from 21.1 million in 2001 to 31.3 million in 2007. According to the Engineering News Record (ENR), The Top 225 Global Contractors 2008, four Chinese construction firms ranked in the top ten and fourteen Chinese construction firms ranked in the top one hundred, compared with only one ranked in the top twenty and nine in the top one hundred in 2001. In terms of international projects, Chinese construction firms also made progress. In 2001, nine Chinese construction firms ranked in the top one hundred of the international contractors and this number rose to thirteen in 2008. The total number of Chinese construction firms ranked in The Top 225 International Contractors also increased from 35 in 2001 to 51, making China the country with the most contractors ranked in

2008.

Despite China's huge progress on its national economy and construction industry, researchers still found many problems within this industry. Xu, Tiong, Chew and Smith (2005) believed that the Chinese construction industry was still considered a weak sector of the economy by international standards because of its inadequate legal framework and mechanism, low productivity, relatively unsophisticated construction equipment and technologies, and low international construction market share with limited types of projects. Sha (2004) concluded that China's construction business system was far from adequate and summarized the deficiencies as imperfect legal environment, poor credibility system, and abnormal behavior of public clients. Sha (2004) also pointed out the problems within China's contracting system, which were characterized by confused contracting for public works, administrative monopoly and local protectionism, and credit crisis and a debt chain. Xu (2001) identified the weaknesses of Chinese construction firms in the competitiveness of continuously making profit, and pointed them out as less effective mechanism, unreasonable industry structure, less advanced equipment and technology, and low international market share and unreasonable distribution of market share. Shen, Zhao, and Drew (2006) further analyzed the unsuccessful entries of foreign-invested construction enterprises (FICEs) into the Chinese construction market. Kwak (2002)

conducted a study analyzing concession projects by foreign construction firms in Asia. The result showed that about 30% of the projects had serious problems, causing substantial financial losses to investors and resulting in cancellation, delay, and suspension of the project. Zhang (2003) conducted a survey about the business performance of FICEs in China and found that, although an increasing number of FICEs had entered into the Chinese construction market, they had not always been successful. Li (2001) recommended that China needed both "hard" investment (construction investment), and "soft" development (system reforms, education and training, policy and regulations), which was increasingly recognized within China by governmental policy-makers, the business and academic communities as the next step in the development.

1.2 Problem Statement

After China was formally admitted to the WTO on December 11, 2001, one of its commitments was to liberalize the construction market (Xu, Tiong, Chew and Smith 2005). China is moving toward a more open and market-driven economy, and as a consequence the Chinese construction market is booming. This boom is likely to remain for the foreseeable future and has been enhanced by China's accession to the WTO. Regulations have been issued by the Ministry of Housing and Urban-Rural

Development of China (MOHURD, previously called Ministry of Construction) to ensure the improvement of the business environment for overseas businesses, including the "Regulation on Administration of Foreign-Invested Construction Enterprises." Before the accession to WTO, FICEs were only allowed to work on limited types of projects (Shen, Zhao, and Drew 2006). Changes in regulations to allow foreign contractors to qualify as wholly foreign-owned "construction firms" came into effect in September 2002 as one of the steps to honor China's WTO commitments (Xu, Smith, and Bower 2005). Now FICEs can build any type of project as long as the project is within the businesses scope defined in the firms' qualification grade. However, it is interesting to note that although the number of FICEs which have registered in China is increasing, the Gross Output Value of FICEs to the total construction output value in China has not increased in recent years. The influence of FICEs on the overall Chinese construction market is still small and some restrictions on project type undertaken by wholly foreign-invested construction firms still exist (Shen, Zhao, and Drew 2006).

Because of these remaining restrictions and the unfamiliarity of U.S. architectural, engineering and construction (AEC) firms with the Chinese construction market, they were only minimally successful in the Chinese market (Chui and Bai 2009). To assist the U.S. AEC firms to become more competitive in

this market, a comprehensive investigation of the Chinese construction industry must be conducted. Studies related to this industry have gradually received more interest in recent years. Mayo and Liu (1995) reported the reform process of the Chinese construction industry from the late 1970s to mid 1990s. Chen (1998) presented the characteristics and current status of China's construction industry. Shen and Song (1998) examined the development of competitive tendering practices in the Chinese construction industry. Li (2001) presented information on the context of China's construction industry transition and the potential roles for improved foreign involvement. Sha and Li (2001) focused on the reform of China's state-owned construction enterprises. Pheng and Jiang (2003) evaluated the achievements of 35 Chinese international contractors to analyze the internationalization of Chinese construction firms. Lam and Chen (2003) studied the development of the construction legal system in China. Sha (2004) found that the construction business system in China had a serious underlying defect and institutional innovation was imperative under the situation. Zen, Chen, and Tam (2005) investigated the industrial structure, the market distribution, and the contributing factors to such a structure in the Chinese construction industry. Tang, Qiang, Duffield, Young, and Lu (2008) reported the need to apply incentives in the delivery of construction projects in China. All of these researchers have studied the Chinese construction industry from different aspects and

time periods. While these studies are either out of date or focused on a particular area, few studies have been found on a comprehensive analysis of the development of the Chinese construction industry.

This research project presents an overview to the development of the Chinese construction industry after the Culture Revolution, details the reform process in terms of administrative framework, laws and regulations, and procurement methods; analyzes its growth trends in different time periods based on statistical data on economic indicators, employees and equipment, and market structure; compares the characteristics of the Chinese and U.S. construction industries, projects its future growth trend; and makes recommendations to U.S. AEC firms which are interested in sharing the Chinese construction market.

1.3 Thesis Organization

This thesis includes the following chapters:

Chapter 1 - Introduction. The thesis starts with this introduction chapter which presents the research background, a general problem statement and a brief description of the thesis organization.

Chapter 2 - Research Objectives and Methodology. This chapter outlines the scope and objectives of this research, and methodology used in data collection, data

analysis and the comparison between the Chinese and U.S. construction industries.

Chapter 3 - Literature Review. This chapter presents the findings of a comprehensive literature review in terms of administrative framework, laws and regulations, procurement methods, and market structure of the Chinese construction industry in each studied time period.

Chapter 4 - Data Collection. This chapter describes various data collection issues including data sources, data collection procedure, and collected datasets.

Chapter 5 - Data Analysis on the Development of the Chinese Construction Industry. This chapter addresses the data analysis procedure and results in each stage in terms of GDP and Gross Output Value, employees and equipment, and market structure.

Chapter 6 - Comparison of the Chinese and U.S. Construction Industries. This chapter discusses the comparison of the characteristics of the Chinese and U.S. construction industries in terms of economic indicators, employees, and construction firm rankings.

Chapter 7 - Conclusions and Recommendations. Finally, this chapter presents the final conclusions drawn from the study and the recommendations to U.S. AEC firms which are interested in conducting business in the Chinese construction market.

Chapter 2

Research Objectives and Methodology

2.1 Objectives and Scope

The primary objectives of this research were to investigate the growth trend of the Chinese construction industry after the Culture Revolution in each stage of its reform, to compare the characteristics of the Chinese construction industry with those of the U.S. construction industry, and to project the future development of the Chinese construction industry. The scope of this research is limited to the Chinese construction industry from 1978 to 2007; investigated areas include its administrative framework, laws and regulations, procurement methods, economic indicators, employees and equipment, and market structure.

Although China liberalized its construction market after the WTO accession in 2001, the market share of foreign construction firms grew much more slowly than that of domestic construction firms and contributed very little to the Gross Output Value of the Chinese construction industry. Foreign construction firms were minimally successful in the Chinese market because they were unfamiliar with this market. The results of this study could be utilized to assist U.S. architectural, engineering and construction (AEC) firms to become more familiar with the Chinese

construction market and be more competitive in this market.

2.2 Methodology

The research objectives were achieved using the following steps:

1. Literature review. A comprehensive literature review was conducted to understand the previous research projects on the reform of the Chinese construction industry. The review findings are presented in Chapter 3 of this thesis. The thirty years was divided into three periods: the first stage of reform from 1978 to 1992, the second stage of reform from 1992 to 2001, and the third stage of reform from 2001 to 2007.

2. Data collection. Statistical data on the Chinese construction industry from 1978 to 2007 were collected from the China Statistical Yearbooks from 1996 through 2008 and were compiled to spreadsheets for statistical analyses. The main indicators include Gross Domestic Product, value added of construction, Gross Output Value of construction, the number of employees, the number of firms, and market structure. Rankings of the Chinese and U.S. construction firms from 2000 to 2007 were obtained from Engineering News Record yearly reports of The Top 225 International Contractors and The Top 225 Global Contractors. Statistical data on the U.S. construction industry from 1978 to 2007 were obtained from the Bureau of Economic

Analysis, U.S. Department of Commerce.

3. Data analysis of the development of the Chinese construction industry. Microsoft Office Excel 2007 and SPSS Statistics 17.0 were used to analyze statistical data. Tables and figures were generated to show the growth trend of the Chinese construction industry in each stage; the main indicators were examined by Pearson correlation to present their statistical correlation.

4. Comparison of the Chinese and U.S. construction industries. The characteristics and growth trends of the Chinese and U.S. construction industries from 1978 to 2007 were determined and compared. The future development of the Chinese construction industry was projected based on both the official exchange rate (the exchange rate determined by national authorities or the rate determined in the legally sanctioned exchange market) and the purchasing power parity conversion factor (the number of units of a foreign country's currency required to buy the same amount of goods and services in its domestic market that a U.S. dollar would buy in the United States).

5. Conclusions and recommendations. Major findings include the characteristics and growth trend of the Chinese construction industry, the differences between the Chinese and U.S. construction industries, and the projection of the future development of the Chinese construction industry. Recommendations were given to

U.S. AEC firms which are interested in conducting business in the Chinese construction market.

Chapter 3

Literature Review

Since 1979, China has been slowly reforming the construction industry, and pushing at adopting an open-door policy directed at oversea business. In October 1992, construction reform was announced at the Chinese Party Congress Convention. These reforms were designed to improve efficiency in the state-owned construction enterprises, to establish a construction market, and to make the Chinese construction firms more competitive with the international firms (Mayo and Liu 1995). After China had been formally admitted to the WTO on December 11, 2001, one of its commitments was to liberalize the construction market (Xu, Tiong, Chew, and Smith 2005). Changes in regulations to allow foreign contractors to qualify as wholly foreign-owned "construction firms" came into effect in September 2002 (Xu, Smith, and Bower 2005). Based on a review of previous studies, the development of the Chinese construction industry after the Culture Revolution is divided into three periods: the first stage of reform from 1978 to 1992, the second stage of reform from 1992 to 2001, and the third stage of reform from 2001 to 2007.

3.1 The First Stage of Reform from 1978 to 1992

3.1.1 Administrative Framework

The Ministry of Housing and Urban-Rural Development of China (MOHURD) is at the top of the administrative framework and plays a leading role in guiding and administering the industry. Since it was set up in 1952, the name of the MOHURD has been changed several times. During the period from 1982 to 1988 it was called the Ministry of Urban and Rural Construction and Environmental Protection (Lu and Fox 2001). It was call the Ministry of Construction until 2008 when it was given the current name during the Eleventh National People's Congress and Chinese People's Political Consultative Conference.

The MOHURD's comprehensive responsibilities include formulating policies, preparing development programs, monitoring implementation, training personnel, improving construction technology and managing standards, surveys, design and construction institutions. The central organization of MOHURD is mirrored in the Construction Commission of the provinces and independent cities. The line ministries at the center also have their mirror image structure in the provinces. The bureaus of the line ministries and the local construction commissions are in charge of the majority of construction work in China (Chen 1998).

The MOHURD shares the duties of regulating construction activities throughout the country with the National Development and Reform Commission (NDRC) (Lu and Fox 2001), which was called the State Development Planning Commission before 2003 and the State Planning Commission before 1998. The NDRC is responsible for making proposals and policies of nationwide fixed capital investment, setting the overall scope and size of fixed capital investment, and appraising and approving requests for funding of capital projects. The commission also coordinates the implementation of priority capital projects, and makes regular inspection to ensure that the state's fixed capital investment program should be implemented as planned (Lu and Fox 2001).

A major difference from most Western countries is the role of People's Construction Bank of China. It is acting as a credit provider on behalf of the government (Bajaj and Zhang 2003), and is responsible for issuing loans to construction projects according to the credit quota issued by the People's Bank of China and reviewing the construction projects at various stages (Chen 1998).

The cities at various levels have their own agencies guiding and regulating construction activities within their jurisdictions, called Construction Commission. The MOHURD, Provincial, City and County Construction Commissions join hands to oversee the construction industry throughout the country. The Provincial, City and

County Construction Commissions report to both the People's Government at the same local level and the MOHURD through the vertical administrative structure (Lu and Fox 2001).

Under the old planning economy system before the 1980s, the Chinese government was not only responsible for freely providing all of the finances for construction works, but was also responsible for assigning projects to contractors for construction. Project clients were various state-owned organizations and their management staff had no responsibility for the overruns of budgets and construction time. There was no competition among contractors and, therefore, no motivation as well because they were not allowed to make profits as the construction industry was considered a nonprofit-making sector in the national economy. The government reimbursed all of the construction costs. There was no system for the control of project costs and construction time. Project-cost estimations and schedule programs were primarily used by the government to allocate finance and resources (Shen and Song 1998). The whole industry could be viewed as a single large firm with a centralized hierarchical organization in which resources, products and services were allocated almost exclusively by administrative means (Chen 1998).

The Chinese construction industry started to reform in the early 1980s following China's open-door policy (Low and Jiang 2003). The efforts had led to

major developments, including the change of project finance from traditionally governmental-free allocations to loans from commercial banks, and the change of project procurement from traditionally governmental assignments to marketing competition (Shen, Li, Drew, and Shen 2004). Walker, Levett, and Flanagan (1998) suggested that the major differences of the Chinese construction market from that in the West include the changes in the move from a planned economy to a socialist market economy, the strong governmental supervision over the majority of construction companies, and the majority of the works commissioned and funded by public sector. Construction industry reforms were announced at the Chinese Party Congress Convention in October 1992 (Mayo and Liu 1995), and the Eighth National People's Congress amended the constitution in 1993 to legalize the reforms in the economy. Since then, China had gradually moved away from a sluggish centrally controlled economy to a new, dynamic, market-oriented mechanism (Bajaj and Zhang 2003).

At the same time, the Chinese government hoped to reform the country's economy without risking any political stability and has worked hard to keep the economy growth rate slow. In 1981 and 1988, the government imposed administrative actions to slow capital construction investment. During the retrenchment periods, the government simply stopped approving new construction projects. The Chinese

Communist Party Congress had also once more demonstrated neither the willingness nor even the ability to relinquish control of the state-owned firms and to establish a system of free firms. Thus, the Chinese construction industry was firmly under the control and protection of the government (Mayo and Liu 1995).

3.1.2 Laws and Regulations

China did not have any unified construction law until 1996 (Lu and Fox, 2001). Before 1992, the existing regulations are listed in Table 3.1.1.

Table 3.1.1 Chinese Construction Regulations before 1992

Name	Year
Ordinance on Contracts of Construction and Installation Works	1983
Provisional Regulation on Tendering for Construction Projects	1984
Chinese-foreign Co-operative Design Regulations	1986
Tentative Regulations on Construction Supervision	1989
Qualification Standards of Construction Enterprises	1989
Qualification Standards of Fitting out and Finishing Enterprises	1989
Regulations On Administration of Construction Market	1991
Tentative Procedures for Site Investigation and Design Firms to Register	1991
Regulations on Administration and Monitoring of Construction Safety	1991
Regulations on Construction Site Management	1991
Rules of Administration of Tendering for Construction Projects	1992
Tentative Regulations of Qualification of Construction Supervision Organizations	1992
Tentative Regulations on Administration of Qualifications of Turnkey Contracting Enterprises	1992
Regulations for administration of Approval for Establishment of Chinese-foreign Joint Venture	1992

Note: Adapted from Lu and Fox (2001). *The Construction Industry in China: Its Image, Employment Prospects and Skill Requirements*.

Without a unified construction law, the Chinese construction legal system was incomplete and had weak jurisdiction over construction activities before the early

1990s. Government administrative control had the dominant influence to the construction market in China before the influence changed to legal monitoring (Shen, Li, Drew, and Shen 2004).

3.1.3 Procurement Methods

Under the traditional planned economic system before 1980s, the assignment method was used widely in China's industries, including the Chinese construction industry. The construction firms were under the direct supervision of the central ministries or local governments. Their operations were restricted by the supervisory government agencies to certain sectors or geographical areas. The obvious weaknesses of the system hindered the healthy development of the construction industry and the problem became more serious as time went on. The central government realized this when Mr. Deng Xiaoping pointed out in 1980 that the construction industry, as an important productive sector, could be a profit-making industry and should be treated accordingly (Lu and Fox, 2001).

In 1980 a World Bank financed project, the Lubuge Hydropower in Yunnan province, used international competitive bidding for its procurement of works. It turned out to be very successful. In 1981 Shenzhen Special Economic Zone was chosen to try competitive bidding for the procurement of works. Encouraged by the success in Shenzhen, on November 7th, 1984, the MOHURD and the NDRC jointly

issued the Provisional Regulations on Tendering for Construction Projects (Lu and Fox, 2001), the first official regulation promoting and governing the application of competitive tendering methods in Chinese construction. In this document the government encouraged the use of competitive tendering methods for construction project contracts wherever applicable (Shen and Song 1998). The document set forth the guidelines and some particulars for bidding and contracting activities (Lu and Fox, 2001). Since its introduction, the competitive tendering approach in the Chinese construction industry has developed rapidly within a short period of time. By the end of the 1980s, the application of tendering methods had become very popular, and many small and new construction firms entered the construction market during this period. Up to 1984, when the principle of tendering was introduced to the Chinese construction industry, there were almost no project contracts procured through tendering (Shen and Song 1998). In 1989, nearly 47,650 projects used bidding for contracts, which accounted for about 13% of the total construction projects. In 1990 bidding was used in 62,922 construction projects, or 18% of the total activity (Chen 1998).

However, due to the lack of control measures, the problem of unfair competition quickly grew to be the most serious problem in the construction market. This problem not only caused many complaints, particularly from state-owned firms

for not being able to find jobs, but also brought light to the problem of bribery for the purpose of obtaining project contracts. Significant doubts were raised at that time within the Chinese construction industry about the applicability of a competitive tendering approach where state-owned firms are the majority. Because some of these firms could not secure jobs, many construction personnel found themselves unemployed. This situation demonstrated the strong need to have a proper management system governing the tendering practice. Consequently, in 1992, the MOHURD issued the formal regulation specifying management measures for controlling tendering practices. The regulation particularly specifies the tendering procedures and regulates the management roles and functions that various government departments should take to ensure fair competition in the market (Shen and Song 1998).

3.1.4 Construction Market Structure

The construction industry in China was not recognized officially as a separate industry until 1983. In the past, it was viewed as a subordinate part of the government investment, and most construction companies in China were state owned. Since China adopted the open door policy, other types of construction companies have grown more popular and are playing a more important role. The Chinese government also encouraged the establishment of other types of construction companies as this could

provide more economic benefit to the society (Chen 1997).

There are three major types of indigenous contractors in China, namely, state-owned enterprises (SOEs), urban and rural collectives (URCs), and rural construction teams (RCTs) (Chen 1998). The SOEs are under the direct management and financial control of the central government, while the URCs are owned by a clan of people (in reality they are owned by states). In 1980, the SOEs did 63.7% of all the construction work. However, the performance of SOEs, the backbone of the Chinese construction industry, was poor and declining. By 1989, the market share of SOEs had decreased to 40.5% (Zeng, Chen, and Tam 2005).

Under the traditional, centralized economic system, SOEs had little autonomy in deciding what to produce, where to invest, and how much to pay the workers. Characterized by the symptoms of the "iron rice bowl" (secured job) and the "large canteen meal" (equalitarian wage rate), SOEs had no means to motivate the staff and workers and to improve their production. The poor performance of SOEs was mainly attributed to the lack of autonomy and the vagueness in the delineation of property rights (Sha and Lin 2001). They had to wait for the government agencies to assign construction works to them. The technical and managerial personnel and the skilled field workers and laborers were allocated by the supervisory government agencies. Building materials, construction equipment, working capital and other

inputs were also allocated by the government as part of the central planning process (Lu and Fox, 2001).

Since the mid 1980s, SOE reform had been the central component of China's overall economic reform package. The reforms were extensive and profound, and many "restricted zones" of theory had been broken down. From the late 1970s to the late 1980s, the Chinese government took managerial decentralization as the key reform. A series of measures were taken to increase the autonomy and incentives of SOEs. In 1981, a "profit-retention system" was tried in some SOEs. At the same time, the state started another experiment called "replacement of profits with taxes." In 1985, the mode of the capital investment in SOEs was changed from interest-free appropriations to bank loans with interest charges. This measure had greatly increased the incentive and productivity of SOEs. The average annual growth rate of total productivity in the state sector was 2.4% per year from 1980 to 1988, with an ascending tendency (Sha and Lin 2001).

However, the number of SOEs running at losses had been rising. As a result, the government's subsidy to SOEs had swelled, taking a 37% jump between 1986 and 1992. Furthermore, the low profit rate of the SOEs was incredible when compared to industrial countries. The implementation of the early stage of reform had revealed that the new institutional arrangements, which simply focused on the managerial

decentralization, had failed to cure SOEs' persistent ailment (Sha and Lin 2001).

At the same time, the growth of URCs and RCTs had been strongly driven by the development of competitive tendering methods. This provided a great deal of opportunities to those non-state-owned firms who might have limited ability to undertake major construction works. On the other hand, the implementation of the national economy reform program had resulted in a great deal of spare workforce from towns and countrysides. A large proportion of such spare workforce had entered into URCs and RCTs (Shen and Song 1998). The market share of the URCs and RCTs changed dramatically from 36.3% in 1980 to 59.5% in 1989 (Zeng, Chen, and Tam 2005).

The URCs and RCTs were different from the SOEs in that: (1) they were market-oriented and did not rely on assignment of projects, but could more easily look for work in the marketplace; (2) their management had more flexibility with respect to size and workers' benefits of the unit; and (3) they were motivated largely by self-interest because the profit was linked firmly to staff income and benefit. However, the output quality of the URCs and RCTs was relatively poor, and their professional and managerial levels were lower than those of the SOEs. They needed modern construction technology, better equipment, proper credit and better educated personnel to improve their quality of work (Chen 1998).

The market share of other types of firms including foreign-funded firms remained 0% from 1980 to 1989 (Zeng, Chen, and Tam 2005), indicating that in this time period the Chinese construction market was generally not opened to international investments.

3.2 The Second Stage of Reform from 1992 to 2001

3.2.1 Administrative Framework

As a direct result of the reform and opening-up policy, various business activities in the construction market were now increasingly brisk. Using international experience and practice for reference, a preliminary construction business model had been set up in China (Sha 2004). Sha (2004) described the basic framework of the model in the following four aspects:

- Corporate organization system. Large and medium-sized public construction projects must be undertaken by the corporate organizations and they take full responsibility for the projects, including planning, financing, implementation and operation, as well as the repayment of debt.
- Tendering and bidding system. The construction projects wholly or

partly funded by the state must be carried out by means of public bidding in the light of the Tendering and Bidding Law. The scope of tendering and bidding covers various activities of a construction project, such as survey, design, construction, supervision, and the procurement of critical equipment and materials.

- Supervision system. Construction projects must be carried out under the supervision of qualified supervisory companies. As the third party in the construction market, supervisory engineers are responsible for the quality control, schedule control, cost control, contract management and information management of the projects on behalf of the owner.
- Contract management system. The contracts for construction projects, including design, construction, procurement and supervision contracts must be awarded based on Contract Law. It is required in a contract to define contractual obligation and specifications, quality requirements, the guarantee for performance of contracts, and the penalty for non-performance of contracts.

However, the construction industry was considered a weak sector of the economy by international standards (Xu, Tiong, Chew, and Smith 2005). Xu, Tiong, Chew, and Smith (2005) concluded the existing problems of the Chinese construction

industry, which were inadequate legal framework and mechanism, low productivity, relatively unsophisticated construction equipment and technologies, and low international construction market share with limited types of projects. Sha (2004) concluded that China's construction business environment was far from adequate and summarized the deficiencies as imperfect legal environment, poor credibility system, and abnormal behavior of public clients. Sha (2004) also pointed out the problems within China's contracting system, which were characterized by confused contracting for public works, administrative monopoly and local protectionism, and credit crisis and a debt chain.

Researchers also discussed the challenges facing the Chinese construction industry within its reform process. Li (2001) believed China should establish more comprehensive legislation and governance, transfer government responsibilities, improve project management, increase housing industrialization, reforming state-owned construction companies, develop sustainable construction, and continue construction education and training. Li (2001) recommended that China needed both "hard" investment (construction investment), and "soft" development (system reforms, education and training, policy and regulations), which was increasingly recognized within China by governmental policy-makers, the business and academic communities as the next step in the development.

3.2.2 Laws and Regulations

With its development over the years, China has established a legal system for governing construction activities. The construction legal system in China mainly consists of the laws and regulations at three levels, including laws, administrative regulations, and departmental rules (Lam and Chen 2004), as shown in Table 3.2.1. The highest governing laws for the Chinese construction industry include two laws promulgated by the National People's Congress of the People's Republic of China (PRC): the Construction Law 1997 and the Bidding and Tendering Law 1999. Among all the laws and regulations on construction matters, the Construction Law is the most important one. The Construction Law provides the governing legal framework for construction activities in China. Its legal effect prevails over construction rules and regulations. As the Construction Law only states several basic rules regarding bidding and does not provide any detailed tendering procedures, the Bidding and Tendering Law was then promulgated to provide the specific tendering and bidding procedures (Lam and Chen 2004).

At the second level are the administrative regulations promulgated by the State Council of PRC. They are mainly concerned with some important issues, such as construction project quality management, registered architects regulations, etc. Departmental regulations and rules are at the third level and are promulgated by the

Table 3.2.1 Major Chinese Construction Laws and Regulations from 1992 to 2001

Level		Titles of Laws or Regulations	Date of Promulgation
Laws		The Construction Law	11/01/1997
		The Bidding and Tendering Law	08/30/1999
Administrative Regulations		Regulations for Administration of Construction Project Quality	01/30/2000
		Regulation for Administration of Construction Project Surveying and Design	09/25/2000
		Regulations on Registered Architects of PRC	09/23/1995
Departmental Rules	Qualification	Regulations for Administration of Qualification of Construction Surveying and Design Units	07/25/2001
		Regulations for Administration of Qualification of Construction Enterprises	04/18/2001
		Regulations for administration of Approval for Establishment of Chinese-foreign Joint Venture Design Institutes	04/16/1992
		Measures for Administration of Qualification of Foreign Contractors Contracting Projects in China	03/22/1994
		Several Regulations Concerning the Establishment of Foreign Investment Construction Enterprises	09/18/1995
		Regulations for Administration of Qualification of Construction Supervision Units	08/29/2001
	Bidding and Tendering	Measures for Administration of Bidding and Tendering for Design in Construction Projects	10/08/2000
		Measures for Administration of Bidding and Tendering for Construction in Building and Municipal Infrastructure Projects	06/01/2001
	Design, Construction, Supervision	Regulations for Administration of Surveying and Design Market in Construction Projects	01/21/1999
		Provisional Measures on Review of Construction Drawings	02/17/2000
		Measures for Administration of Construction Permission in Construction Projects	07/04/2001
		Regulations on Construction Supervision	12/15/1995
		Regulations on Scope and Standards of Scale of Construction Supervision	01/17/2001
		Provisional Regulations on Completion Check of House Buildings and Municipal Infrastructure	06/30/2000
		Provisional Regulations on the Procedures for Administrative Penalties in Construction Projects	02/03/1999
	Mandatory Standards	Regulations on Supervision for Implementation of Construction Project Mandatory Standards	08/25/2000

Note: Adapted from Lam and Chen (2004). The Development of the Construction Legal System in China. *Construction Management and Economics*, 22, 347-356.

MOHURD (Lam and Chen 2004). They involve many aspects for governing construction activities relating to qualifications of contractors, soil and site investigators, design institutes, design and construction codes and standards, competitive tendering, etc. These laws, administrative regulations, and departmental regulations and rules altogether establish a construction legal system in China (Lam and Chen 2004). Lu and Fox (2001) summarized the rules regulating the construction market, participants in the construction industry, quality, and safety, as shown in Table 3.2.2.

3.2.3 Procurement Methods

The practice of tendering has developed rapidly since the beginning of the 1990s. In 1990, the number of project under contract bid was 20.7% of the total construction project, 26.2% in 1992, 30.1% in 1993, and 34.5% in 1995 (Shen and Song 1998). Bidding had been used not only in the field of construction and installation, but also had been introduced into design, equipment purchasing and turnkey projects (Chen 1998). It had become a legal requirement to award all public sector contracts through bidding procedures since January 2000, when the Bidding and Tendering Law was introduced (Shen, Li, Drew, and Shen 2004).

Table 3.2.2 Rules Regulating the Construction Market, Participants in the Construction Industry, Quality, and Safety

Rules Regulating the Construction Market	Year
Ordinance on Contracts of Construction and Installation Works	1983
Provisional Rule of Tendering for Construction Projects	1984
Tentative Regulations on Construction Supervision	1989
Regulations On Administration of Construction Market	1991
Rules of Administration of Tendering for Construction Works	1992
Procedure for Administration of Construction Contract	1993
Procedure fro Registering Construction Projects	1994
Chapter 16 of the Contract Law	1999
Model Conditions of Contract for Works of Building Construction	1999
Tendering law of the People's Republic of China	1999
Contract Law of the People's Republic of China	1999
Regulations on Contract Administration	N/A
Rules Regulating Participants in Construction Industry	**Year**
Qualification Standards of Construction Enterprises	1989
Qualification Standards of Fitting out and Finishing Enterprises	1989
Tentative Procedures for Site Investigation and Design Firms to Register	1991
Tentative Regulations of Qualification of Construction Supervision Organizations	1992
Tentative Regulations on Administration of Qualifications of Turnkey Contracting Enterprises	1992
Tentative Provisions on Qualifying Foreign Contractors for Undertaking Construction Works in China	1994
Regulations on Administration of Qualifications of Construction Enterprises	1995
Regulations on Registered Architects	1995
Provisions on Forming Construction Enterprises by Foreigners in China	1995
Regulations on Administration of Qualification of Site Investigation and Design Firms	1997
Rules for Governing Quality and Safety in Construction	**Year**
Regulations on Administration and Monitoring of Construction Safety	1991
Regulations on Construction Site Management	1991
Regulations on Construction Quality	1993
Regulations of Construction Quality Administration	2000

Note: Adapted from Lu and Fox (2001). *The Construction Industry in China: Its Image, Employment Prospects and Skill Requirements*.

Shen and Song (1998) summarized the characteristics of the competitive tendering practice in China. While the competitive tendering methods had been applied to a wide range of construction projects, the majority of tendering projects were commercial and residential buildings. According to general governmental guidelines, any construction project with a large monetary value should be bid upon. The finance sources for construction projects were varied, including government, state-owned organizations, collective, joint ventures, foreign-only investments, etc. Common tendering methods, such as open tendering, selective tendering, and negotiation, had been introduced, but selective tendering was the major method used in Chinese construction procurement. The criteria for selecting a successful bidder varied with different projects.

Despite its progress, the system for competitive bidding was not yet fully established and needs to be improved. Bidding and assignment were taking place at the same time, in what may be called “partial bidding”. Negotiation with submitted bidders was still very common. Bidding documents, procurement procedures and qualification requirements for construction firms and design institutes were not standardized (Chen 1998). Shen and Song (1998) also concluded that the major outstanding problems in the tendering practice were partial competition, inconsistency of procurement documentation, construction triangular debt, challenge

to state-owned construction enterprises, and lack of legal control.

3.2.4 Construction Market Structure

Since the reform of the Chinese construction industry, the market share of the SOEs has been continuously decreasing. In 1989, the market share of the SOEs was 40.5%; it dropped to 39.5% in 1994, 32.1% in 1999, and finally 26.8% in 2001. At the same time, the market share of the URCs and RCTs also decreased from 59.5% in 1989 to 39.8% in 2001. However during this period, the market share of other types of firms, including foreign funded firms and private companies, had increased dramatically from 0% in 1989 and reached 33.4% in 2001. Meanwhile, the economic return of the SOEs was dropping with the declining rates of profitability. The SOEs had the lowest profitability when compared to other forms of firms, decreasing from 2% in 1993 to 0.8% in 2002 (Zeng, Chen, and Tam 2005).

Since the late 1980s the vagueness in delineating property rights had been regarded as the major cause of the declining profits of SOEs. Hence, the central issue of the further SOE reform was to change the property rights or the ownership structure of SOEs. The stock based system and privatization had been proposed as the major solutions to the SOE reform. However, it was not appropriate for most unprofitable SOEs to adopt the stock holding system. Many SOEs that had adopted this system were still faced with the problem of declining profits and the erosion of

state assets and property (Sha and Lin 2001).

Since the early 1990s, some of the largest state owned construction enterprises had gained experience in the international market (Low and Jiang 2003). The Chinese construction firms still had a low international construction market share with limited types of projects in late 1990s and were still unable to match the performance of their counterparts from developed countries. The international market shares of Chinese construction firms were concentrated in Asia and Africa, whereas there was little presence in the Latin American, the U.S., and European construction markets. As to market segmentation, China construction firms were focused mainly in traditional construction projects, such as general and industrial buildings, with fewer in specialist technology areas, such as intelligent buildings, underground rapid transit systems, and nuclear power stations. The majority of them derived their profits from exporting contract labor rather than from technology or management service (Xu, Tiong, Chew, and Smith 2005).

Foreign contractors, in general, had restricted entry to the Chinese construction market (Chen 1998). Before 2001, foreign contractors were only allowed to tender for World Bank, Asian Development Bank, and multilateral projects (Xu, Tiong, Chew, and Smith 2005). Foreign joint venture, foreign aid or specialist trade projects, where advanced technology was required, and technology transfer to China

were a feature of the project. If a Chinese construction company was capable of providing the same end product, foreign contractors might be prevented from taking part (Chen 1998). Although regulations that allow foreign contractors and foreign design firms to register as wholly foreign owned "construction firms" and "construction engineering design firms," respectively, were both effected in December 2002, the scope of services was limited in foreign funded projects and those domestic funded projects that required special technologies. The Chinese construction market and construction firms were still largely under the protection and control of the government (Xu, Tiong, Chew, and Smith 2005).

3.3 The Third Stage of Reform from 2001 to 2007

3.3.1 The WTO Commitment in Construction Market

After China had been formally admitted to the WTO on December 11, 2001, one of its commitments was to liberalize the construction market. During the negotiations between China and other WTO member countries regarding China's entry into the WTO, some of the countries required China to open its construction market to foreign companies, especially those from Japan, the United States, and Europe (Xu, Tiong, Chew, and Smith 2005). In the WTO entry negotiations concerning the construction industry, China presented itself as a developing country, persisted in the basic

principles of mutual benefits and a win-win strategy, and promised to implement the commitments. China became a WTO member country, as it aimed to achieve the maximum protection in the development of China's construction industry. As a result, China's construction industry will open its doors to the outside world in a progressive and limited way as described below (Chui 2006):

1. Commitments to design and consulting services
    a) Limitation in market access.
        i. Unbound for cross-border deliveries of plan designs, other types of cross-border deliveries are required in cooperation with Chinese design institutes.
        ii. Only joint ventures with a foreign majority ownership are permitted. Within the first five years of China's accession to the WTO, only wholly foreign-owned firms will be permitted.
    b) Limitation on national treatment.
        i. Foreign service providers must be certified architects, engineers or firms engaging in construction design, engineering and urban planning in their resident countries.
2. Commitments to construction

a) Limitation in market access. Sino-foreign joint venture firms with a foreign majority ownership are permitted. Within the first three years of China's accession to the WTO, wholly foreign-owned firms will be permitted. Wholly foreign-owned firms can only undertake the following four types of construction projects:

   i. Construction projects wholly financed by foreign investments and/or grants.

   ii. Construction projects financed by loans from international financial institution awarded through international tendering according to the terms of the loans.

   iii. Chinese-foreign jointly constructed projects with a foreign investment equal to or more than 50 percent; a Chinese-foreign jointly constructed projects with a foreign investment less than 50 percent but technically difficult to be built by Chinese construction firms alone.

   iv. Chinese-invested construction projects difficult to build by Chinese construction firms alone can be jointly undertaken by Chinese and foreign construction firms with approval from the provincial government.

3. Commitments to national treatment. There is little difference in requirements in registered capital between the present Sino-foreign joint venture firms and Chinese firms. The limitations will be abolished within three years of China's entry into the WTO.
4. Commitments to related countries. Commitments made in bilateral talks upon joining the WTO with Japan are also adaptable to all WTO member countries.
    a) According to the principle of national treatment, China will do its best to lower the standard minimum amount of registered capital for wholly foreign-owned construction firms and Sino-foreign joint ventures and cooperation construction firms.
    b) In the regulations (within three years of China's WTO membership), China will put the contracting performance of the parent companies into consideration when evaluating the new qualification level for wholly foreign-owned construction firms.
    c) China will retain the present regulations that stipulate foreign construction firms can contract construction work without establishing a business presence in China until the new regulations allowing wholly foreign-owned construction firms in China come

into effect.

d) China will publicize a notice before the deadline for the present regulations. Even if the regulations are abolished, construction contracts approved beforehand will be implemented.

3.3.2 The WTO Impact on the Construction Legal System

After joining the WTO, it is necessary for China to implement substantive reforms on the economic system, legal system, legal framework and principles of law enforcement, so as to make its economic system meet the requirements of a market economy and its laws and legal systems meet the requirements of a society governed by the rule of law (Lam and Chen 2004).

After realizing the necessity of accelerating the step of modifying those laws and regulations unfit for the WTO requirements, the MOHURD established a special task team, whose duties were to check laws, administrative regulations, departmental rules and regulatory documents pertaining to construction according to the general principles of WTO (Lam and Chen 2004).

To meet the requirements of WTO agreements, many regulations were abolished or modified. Because of too many constraints on foreign participation, the Chinese-foreign Cooperative Design Regulations 1986, the Foreigners' Private Housing Regulations 1984, and the Urban Public Housing Regulations 1994 were

abolished. The Construction Supervision Unit Qualification Regulations 2001 was promulgated to replace the Construction Supervision Unit Qualification Provisional Regulations 1992. Due to restrictions on the participation of foreign companies in tendering activities, the Construction Tendering and Bidding Regulations 1992 was replaced by the Municipal Infrastructure Construction Tendering and Bidding Regulations 2001. Some relatively new regulations were also modified. The Surveying and Design Units' Qualification Regulations 2001 superseded the previous one of 1997, as the previous version set many restrictions on contracting design tasks by foreign designers (Lam and Chen 2004).

3.3.3 Construction Market Structure after WTO

In September 1999, the Decision on Major Issues Concerning the Reform and Development of SOEs was adopted in the 15th Central Committee of the Communist Party of China. In accordance with the fundamental transformation of the economic structure and economic growth, the objectives for the reform and development of SOEs by the year 2010 were proposed as (Sha and Lin 2001):

- Developing diverse forms of ownership in parallel with public ownership, but public ownership remaining dominant.
- Completing the strategic readjustment and restructuring, creating a more rational layout and structure for the state-owned economy.

- Establishing a fairly complete modern corporate system.
- Significantly strengthening the capabilities of scientific and technological development, market competition and risk resistance, and markedly improving the performance of SOEs.

Developing these objectives established the framework for deepening the reform and development of SOEs, and further efforts were required both in theory and practice (Sha and Lin 2001).

The rapid growth of the URCs and RCTs in China's construction industry helped contributed to the country's economic reforms towards a market-oriented system. Since the early 2000s, there has been an increasing trend for the emergence of private construction companies, due to the privatization of some URCs and RCTs. However, the number of private construction companies is still small relative to the entire construction industry. The quality of the URCs, RCTs, and the private construction companies, is relatively poorer because of their lower level of professional skills and technological management (Low and Jiang 2003).

In 2001, Chinese construction companies expanded their businesses in more than 190 countries with 39,400 new contracts with a total contract value of U.S. $16.45 billion. Where projects were concerned, the contracts successfully won by Chinese companies fall into the following categories (Low and Jiang 2003):

- Project funded through Chinese government loans or financial aid to developing countries,
- Projects funded by loans from the World Bank or Asian Development Bank,
- Projects obtained through government bilateral trade agreements,
- Projects won through international bidding,
- Projects obtained through local clients, and
- Projects obtained through local branch offices of Chinese firms.

Although Chinese international construction firms have made great strides in the global market, their scale of overseas operations is still small relative to their European, Japanese, and North American counterparts (Low and Jiang 2003).

Foreign invested construction firms can now build any type of project so long as the project is within the businesses scope defined in the firms' qualification grade. In 2003, there were 287 foreign invested construction firms registered in China to operate as main contractors or specialist contractors, with a total of 60,000 employees. However, the gross output value of construction by foreign invested firms to the total construction output value in China has not increased in recent years, which indicates that the influence by foreign invested firms on the overall Chinese construction market is small. Some restrictions on the types of project undertaken by

wholly foreign invested construction firms still exist. While wholly foreign invested construction firms could register for business licenses since 2003, they are limited to work on certain type of projects. These mainly comprise foreign-invested projects including (1) projects wholly funded by foreign investments or foreign grants; (2) projects financed by international financial organizations through an international bidding process; and (3) Sino-foreign jointly invested projects in which the foreign investment is not less than 50%, or in which the foreign investment is less than 50% but the Chinese partner cannot construct the project independently due to technical difficulties (Shen, Zhao, and Drew 2003).

Low and Jiang (2003) identified the following characteristics of China's construction industry and firms: large domestic market and huge construction work forces; labor intensive and less open industry; specialized firms; delineation between design and construction; and separation of research and development.

3.4 Participation in the International Construction Market

The beginning of Chinese construction firms participating in international projects can be traced back to the 1950s when the Chinese government provided economic and technical aid to other developing countries. The historical penetration of the international construction market by Chinese firms can generally be divided into three

stages (Low and Jiang 2003).

Before 1979, the Chinese government provided economic and technical aid to other developing countries as financial donations to achieve the objective of "liberation and independence of brother countries in the third world." The international involvement of Chinese construction firms was mainly for financial aid projects in some developing countries with funds provided by the Chinese government. However, these projects did not technically constitute part of the international construction market because they were not profit-driven for the firms and were funded by the Chinese government, and the Chinese construction firms were not involved in any decision-making activities (Low and Jiang 2003).

In August 1979, following China's open-door policy, China's State Council introduced an act which allowed Chinese specialized companies to invest in other countries, including construction firms. Several central government-level SOEs were separated from governmental departments subsequently and were able to obtain licenses to bid for projects in the international market after mid 1980s. Some of the largest SOEs were established soon after China's first international construction firm was set up in November 1978. The operations of these firms from then on were independent of financial aid from the Chinese government. They participated in international bidding, tendered for commercial projects and negotiated with their

foreign counterparts. Their motivation soon turned to one that is profit-driven from going abroad (Low and Jiang 2003).

Since the early 1990s, provincial-level and some other regional companies were allowed to obtain licenses for contracting overseas. By 1994, several of the more established Chinese international construction companies had shaped up. The more profitable firms were encouraged to list in the stock market as an important management and financial strategy, which means they would no longer be protected by the government. To be listed on the stock market, construction firms off-loaded their unprofitable assets in favor of more favorable assets to form new share-holding companies. However, many Chinese international construction firms struggled through the process of reforms to become multinational firms in the global market (Low and Jiang 2003).

By 2001, Chinese construction companies had conducted businesses in Asia, Africa, Latin American, U.S., and European construction markets (Xu, Tiong, Chew, and Smith 2005). According to the ranking of international contractors by ENR in 2001, 35 Chinese firms were listed among the top 225 international contractors in the world. The total international revenue of these 35 contractors was U.S. $5.383 billion in 2000 (Low and Jiang 2003).

However, the share by Chinese contractors in the international market is still much smaller in comparison with their capacity. A report by the MOHURD in 2003 indicated that the value of construction works contracted by Chinese contractors in the international markets was only about 1% of the total works. Their major overseas markets are in the developing countries in Asia and Africa, while they have started entering into the construction markets in Europe and the U.S. since 2000 (Zhao and Shen 2008). Zhao and Shen (2008) identified Chinese international contractors' (CICs) strengths, weaknesses, opportunities and threats (SWOT) in the international construction market, as shown in Table 3.4.1.

The major overseas markets of Chinese construction firms were in Asia/Australasia (see Figure 3.4.1), which accounted for over 70% of their international billings. Over the past decade, Chinese construction firms have expanded their international operations all over the world, first to Asia/Australasia, then to Africa, North America and East Europe, and finally to Latin America. The major factors that contributed to their rapid expansion overseas recently include an abundant supply of cheap and skilled manpower from China; their high degree of motivation and adaptability working in different environments; strong government support and financing flexibility; and historical links with developing countries (Low, Jiang, and Leong 2004).

Table 3.4.1 CICs' SWOT Factors in International Construction Market

SWOT factors	CICs' SWOT
Strength (S) and Weakness (W) factors Management ability Financial ability Technological ability Resources differences Cost differences	S1 = Manpower with low cost, good skills and high degree of adaptability working in different environments S2 = Lower price of construction components S3 = Advancement in certain technologies S4 = Advantageous geographical location S5 = Good relationship with developing countries W1 = Lack of well-trained human resources W2 = Absence of design capability W3 = Weak financial capability W4 = Language disadvantage
Opportunity (O) and Threat (T) factors Social and political environment Economic environment Market and competition	O1 = Governmental encouragement and promotion O2 = Financial support by state-owned banks O3 = The increase of Chinese enterprises' overseas investments O4 = Development of the construction industry in the countries where CICs are well established O5 = Exploring new markets in line with China's accession to the WTO O6 = Further opening up in Africa for CICs T1 = High business risks T2 = High political risks T3 = Growth of competition T4 = The increase in value of the Chinese currency and the pressure from domestic inflation

Note: Adapted from Zhao and Shen (2008). *Are Chinese Contractors Competitive in International Markets?*

Ling, Ibbs, and Cuervo (2005) studied the entry mode and business strategies which international architectural, engineering and construction (AEC) firms used when undertaking projects in China, and concluded that among 13 possible entry modes, only three were perceived to be effective in helping the project achieve

1985

No. of firms	2
Total	140.0

1990

No. of firms	3
Total	769.8

1995

No. of firms	23
Middle East	391.7
Asia/Australasia	2082.1
Africa	390.4
Europe	53.8
North America	28.8
Latin America	25.9
Total	2972.7

2000

No. of firms	35
Middle East	490.0
Asia/Australasia	3978.7
Africa	540.0
Europe	100.1
North America	86.0
Latin America	168.6
Total	5363.4

1–4 firms
5–9 firms
10–20 firms
Home

Figure 3.4.1 Global Movement of Top Chinese Construction Firms in the International Construction Market (1985–2000)
(Source:ENR, various issues)

Note: Adapted from Low, Jiang and Leong (2004). "A comparative Study of Top British and Chinese International Contractors in the Global Market".

success, which were setting up a branch office in China, setting up a subsidiary firm in China, and setting up a project joint venture with a Chinese firm. Those that did not produce a successful outcome include forming equity joint ventures and merging or acquiring a Chinese firm. Two strategies (provided speciality or niche product or service, and built network and contacts in China) were pursued by all the respondents. Three strategies related to project financing were perceived to be ineffective in helping the project achieve success. Ling, Ibbs, and Cuervo (2005) concluded that foreign AEC firms should offer niche products or services at competitive prices; should post-management staff from home countries to manage the projects, but use professional staff from China and Chinese subcontractors to execute the projects; should not be offering project financing or take an equity in China's projects, but should be able to help clients structure a financing package for projects in China; and should have networking with the right people in China.

Ling, Low, Wang, and Egbelakin (2008) developed and tested five models to predict the likely project success levels, based on project management practices adopted by foreign AEC firms in China. These were cost performance, time performance, quality performance, owner satisfaction, and profit margin. They found that a firm's response to perceived change orders was the most important project management practice that affects these five areas of project performance. The study

also found that international construction firms need to adopt some unconventional project management practices. First, project managers should not be too focused on monitoring activities to detect cost overrun as this would lead to poor schedule performance. Second, foreign AEC firms should not adopt a mindset of sending their most talented staff to China to solve all the project problems since paying expatriate staff generous allowance in China does not help in improving quality performance. Third, foreign AEC firms should refrain from bidding out one mammoth project.

Ling, Ibbs, and Hoo (2006) did a similar study about the determinants of international AEC firms' project success in China. They concluded that the variable that affects the most number of success measures was the firm's ability to understand the client's requirements. Two other variables also affected project success: the AEC firms' product quality, and the AEC firms that set out to acquire an international reputation. Firms that have superior product quality would have better functional and architectural quality, high owner satisfaction, and profitability. Having core competencies and good business practices was also considered as critical success factors for projects in China. They recommended that international AEC firms set up an effective project team made up of competent architects, engineers, and project managers, whose most important duties were to understand the clients' requirements and provide superior product service or quality. Lu, Shen, and Yam (2008) also

analyzed 35 critical success factors and grouped them into eight clusters, namely, project management skills, organization structure, resources, competitive strategy, relationships, bidding, marketing, and technology.

3.5 Summary

Chapter 3 presents the results of the literature review to develop a background of the Chinese construction industry. Findings of the literature review were summarized based on three stages of the Chinese construction industry, which are the first stage of reform from 1978 to 1992, the second stage of reform from 1992 to 2001, and the third stage of reform from 2001 to 2007. The subjects included the administrative framework, laws and regulations, procurement methods, construction market structure, China's WTO commitment in the construction market, and the WTO impact on the construction legal system. The development of Chinese international construction firms and their participation in the international construction market were also presented in this chapter.

According to the literature, the Chinese construction industry has three thresholds. Since 1979, China's open-door policy has been slowly reforming the construction industry. In 1992, construction reform was announced at the Chinese Party Congress Convention to establish a free construction market. After December

2001 when it was formally admitted to the WTO, China was performing its commitments to liberalize the construction market.

Chapter 4

Data Collection

4.1 Data Collection Procedure

4.1.1 Data Sources

This study focuses on the development of the Chinese construction industry from 1978 to 2007, the growth trend in each stage of its reform, the comparison with the U.S. construction industry, and the projection of its future development. Data used in this research include three parts: data on the Chinese construction industry from 1978 to 2007, data on the U.S. construction industry from 1978 to 2007, and rankings of the Chinese and U.S. construction firms from 2000 to 2007. All data were compiled into spreadsheets for statistical analysis.

Data on the Chinese construction industry from 1978 to 2007 were obtained from the China Statistical Yearbooks 1996 through 2008. Data on Gross Domestic Product (GDP) and composition of GDP from 1978 to 2007, pieces of equipment owned by construction firms from 1991 to 2007, and main indicators on construction firms (number of firms, number of employees, and Gross Output Value) from 1995 to 2007, were collected from the China Statistical Yearbook 2008; data on main indicators on construction firms from 1980 to 1994 were collected from the China

Statistical Yearbook 1996; data on main economic indicators on construction firms by registration status (number of firms, Gross Output Value, and profit rate) from 1995 to 2007 were collected from the China Statistical Yearbook in each corresponding year. Some data before 1995 are unavailable from the available data sources.

Data on the U.S. construction industry from 1978 to 2007 were obtained from the Bureau of Economic Analysis, U.S. Department of Commerce. Data on GDP and value added of construction from 1978 to 2007, Gross Output Value of construction from 1987 to 2007, and number of full-time and part-time employees from 1978 to 2007 were collected from the North American Industry Classification System (NAICS); data on Gross Output Value of construction from 1978 to 1986 were collected from the Standard Industrial Classification (SIC) System, which was replaced by the NAICS starting in 1997. The reason for using the SIC data is that data on Gross Output Value of construction from the NAICS only started from 1987. It should be noted that for data on Gross Output Value of construction from 1987 to1997, which both the NAICS and the SIC have, there is about a 5% discrepancy, indicating that data on Gross Output Value of construction from the two standards may not be linked smoothly.

The rankings of the Chinese and U.S. construction firms from 2000 to 2007 were obtained from Engineering News Record yearly reports of The Top 225

International Contractors and The Top 225 Global Contractors from 2001 to 2008. The Top 225 Global Contractors are ranked by their construction contracting revenue both at home and abroad; Top 225 International Contractors are ranked according to construction revenue generated outside of each company's home country.

4.1.2 Terminology

GDP refers to the final products at market prices produced by all resident units in a country (or a region) during a certain period of time. GDP is expressed in three different perspectives, namely value, income, and products. GDP, in its value perspective, refers to the total value of all goods and services produced by all resident units during a certain period of time, minus the total value of input of goods and services of the nature of non-fixed assets. In other words, it is the sum of the value-added of all resident units. GDP, from the perspective of income, includes the primary income created by all resident units and distributed to resident and non-resident units. GDP, from the perspective of products, refers to the value of all goods and services for final demand by all resident units minus the imports of goods and services during a given period of time (China Statistical Yearbook 2008).

Value added of the construction industry refers to the final result of the activities of production and operation of firms of the construction industry in monetary terms during the reference period. Value added of construction is calculated

by both production approach and income approach, with the figures from the income approach as the final figures. Under the income approach, the calculation starts from the perspective of income and is based on the share of income derived from the production process by the relevant factors of production (China Statistical Yearbook 2008).

Gross Output Value of the construction industry refers to the total of construction products and services, expressed in money terms, produced or rendered by construction and installation firms during a given period of time. It includes: (1) output value of construction projects: the value of projects covered by the project budgets; (2) output value of installation projects: the value of the installation of equipment, (excluding the value of the equipment to be installed); and (3) other output values: the output value of the construction industry apart from that of construction projects and installation projects. It includes: output value of repair of buildings and structures; output value of non-standard equipment manufacturing; overhead expenses received by contracted firms from the sub-contracted firms and the completed output value of construction activities for which there is no clear definition (China Statistical Yearbook 2008).

4.2 Collected Datasets

4.2.1 The Chinese Construction Industry

Data on the Chinese construction industry from 1978 to 2007 include GDP, value added of construction, growth rate, percentage of value added of construction in GDP, Gross Output Value of construction, profit rate, number of employees, pieces of equipment, and number of construction firms, including state owned enterprises, urban and rural collectives, rural construction teams, firms funded from Hong Kong, Macao and Taiwan, foreign funded firms, and other types of domestic funded firms. Because data were obtained from multiple sources, the available time period differs in some items, such as profit rate, pieces of equipment, and number of construction firms.

4.2.2 The U.S. Construction Industry

Data on the U.S. construction industry from 1978 to 2007 include Gross Domestic Product, value added of construction, percentage of value added of construction in GDP, Gross Output Value of construction, and number of full-time and part-time employees.

4.2.3 Rankings of the Chinese and U.S. Construction Firms

Data on Rankings of the Chinese and U.S. construction firms from 2000 to 2007 include the number of construction firms ranked in top 10, between 11 and 50, 51 and

100, 101 and 225, and the total number ranked in top 225 of global and international lists.

Chapter 5

Data Analysis on the Development of the Chinese Construction Industry

In this chapter, data analysis is divided into three periods based on the Chinese construction industry development stages, which are the first stage of reform from 1978 to 1992, the second stage of reform from 1992 to 2001, and the third stage of reform from 2001 to 2007. In each stage, data analysis was conducted in terms of Gross Domestic Product (GDP) and Gross Output Value, employees and equipment, and market structure.

5.1 Development during the First Stage of Reform from 1978 to 1992

5.1.1 GDP and Gross Output Value

Table 5.1.1 shows China's GDP, value added of construction, percentage of construction in GDP, Gross Output Value, and average growth rate from 1978 to 1992. The growth rates of GDP and value added of construction were obtained directly from the China Statistical Yearbooks which used unexplained formulas. During the 15 years, the average growth rate of GDP was 9.59%, slightly below that of value added of construction, which was 10.0%. But for Gross Output Value of construction, its

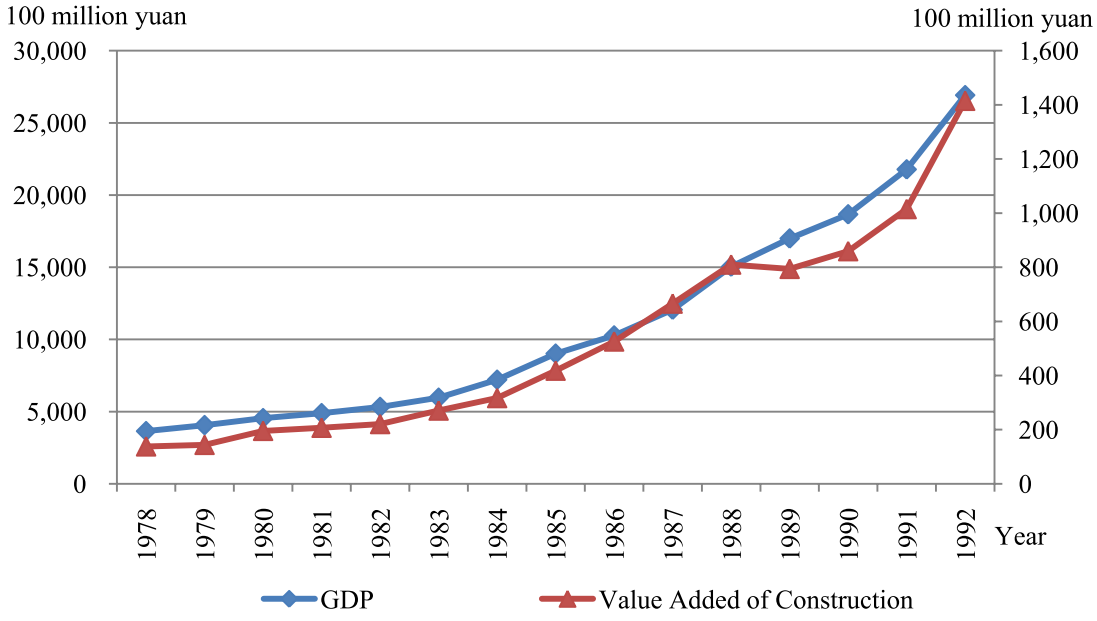
average growth rate of 18.79% was almost twice that of GDP. These higher growth rates indicate that during the first stage of the economic reform, the development of the Chinese Construction Industry grew faster than the overall economy.

Table 5.1.1 GDP and Gross Output Value from 1978 to 1992

Year	GDP (100 million yuan)	Value Added of Construction (100 million yuan)	Percentage of Construction in GDP (%)	Gross Output Value (100 million yuan)
1978	3,645.22	138.20	3.79	-
1979	4,062.58	143.80	3.54	-
1980	4,545.62	195.50	4.30	286.93
1981	4,891.56	207.10	4.23	-
1982	5,323.35	220.70	4.15	-
1983	5,962.65	270.60	4.54	-
1984	7,208.05	316.70	4.39	517.15
1985	9,016.04	417.90	4.64	675.10
1986	10,275.18	525.70	5.12	739.53
1987	12,058.62	665.80	5.52	875.83
1988	15,042.82	810.00	5.38	1,043.37
1989	16,992.32	794.00	4.67	1,178.98
1990	18,667.82	859.40	4.60	1,345.01
1991	21,781.50	1,015.10	4.66	1,425.48
1992	26,923.48	1,415.00	5.26	1,989.90
Average Growth Rate (%)	9.59	10.00	-	18.79

Note: Adapted from the China Statistical Yearbooks 1996 and 2008

During the first stage of reform, GDP experienced a smooth and steady growth, as presented in Figure 5.1.1. Value added of construction shared the same growth rate until 1989, when it had a negative growth rate of -8.44%. Then value added of construction caught up with a higher growth rate in the following years.



Note: GDP uses the left scale; Value Added of Construction uses the right scale.

Figure 5.1.1 GDP and Value Added of Construction from 1978 to 1992

Table 5.1.2 shows the Pearson correlation of GDP and value added of construction during the 15 years period. In statistics, the correlation coefficient indicates the strength and direction of a linear relationship between two random variables. Pearson correlation is used in this chapter to measure the correlation of the main indicators. It is obtained by dividing the covariance of the two variables by the product of their standard deviations. The correlation is 1 in the case of an increasing linear relationship, -1 in the case of a decreasing linear relationship, and values in between in all other cases indicate the degree of linear dependence between the variables. The closer the coefficient is to either -1 or 1, the stronger the correlation between the variables (Rodgers and Nicewander 1988). The Pearson correlation of

GDP and value added of construction is 0.993, and this correlation is significant at the 0.01 level, demonstrating that the growth of value added of construction had a considerably strong correlation with that of GDP.

Table 5.1.2 Pearson Correlation of GDP and Value Added of Construction from 1978 to 1992

		Value Added of Construction
GDP	Pearson Correlation	.993*
	Sig. (2-tailed)	.000
	N	15

*. Correlation is significant at the 0.01 level (2-tailed).

While the difference of value added and Gross Output Value of construction was slight in 1980, it began to increase after 1988, as illustrated in Figure 5.1.2. Gross Output Value grew steadily until 1992, when it experienced a dramatic rise. The Pearson correlation of value added of construction and Gross Output Value is 0.976 and is significant at the 0.01 level (see Table 5.1.3), representing that the growth of value added of construction was strongly correlated with that of Gross Output Value.

Table 5.1.3 Pearson Correlation of Value Added of Construction and Gross Output Value from 1978 to 1992

		Gross Output Value
Value Added of Construction	Pearson Correlation	.976*
	Sig. (2-tailed)	.000
	N	15

*. Correlation is significant at the 0.01 level (2-tailed).

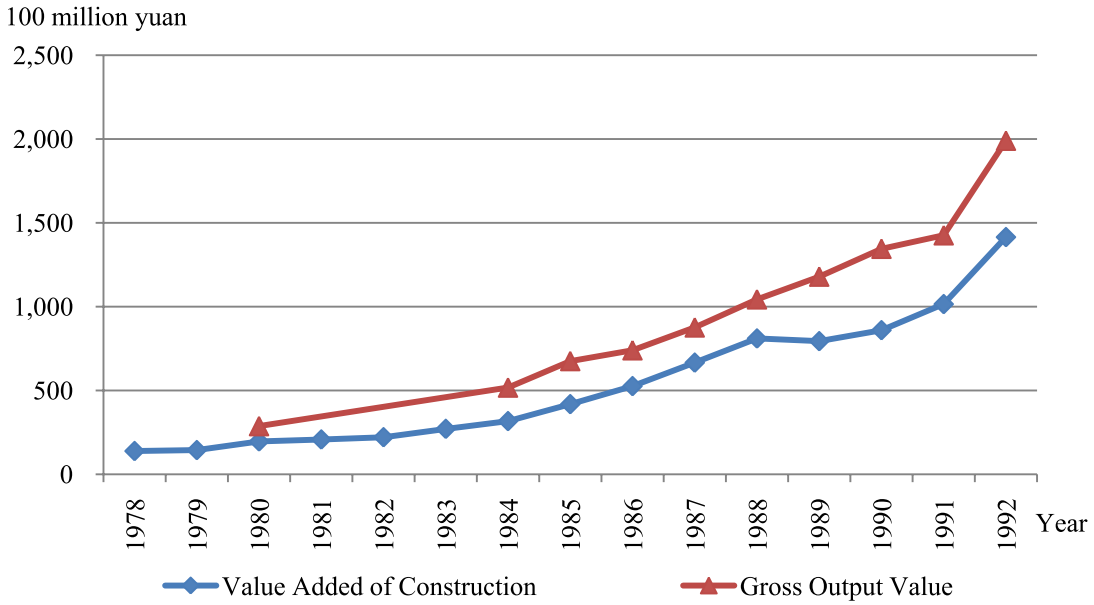


Figure 5.1.2 Value Added of Construction and Gross Output Value from 1978 to 1992

The percentage of construction in GDP from 1978 to 1992 is displayed in Figure 5.1.3. It began at 3.79% and fluctuated and trended upward, hitting the summit at 5.52% in 1987 with an average percentage of 4.59%. This growth trend suggests that although the Chinese construction industry was developing during the 15 years, it was unstable and prone to fluctuate.

5.1.2 Employees and Equipment

Table 5.1.4 shows the number of employees and pieces of equipment from 1978 to 1992 (data on employees are not available in 1978, 1979, and from 1981 to 1983; data on equipment are not available before 1991). Compared with that of GDP, value added of construction, and Gross Output Value of construction, the growth rate of the

number of employees was relatively small at only 2.98%. From 1980 to 1992, the number of employees increased by 64.46%, while value added of construction increased by 623.78% and Gross Output Value increased by 593.51%. These data reflect that the output values created by individual employees increased dramatically during the first stage of reform. The growth of the number of employees is depicted in Figure 5.1.4. It climbed slowly from 1980 to 1988, dropped by 4.13% in 1989 and rose again smoothly.

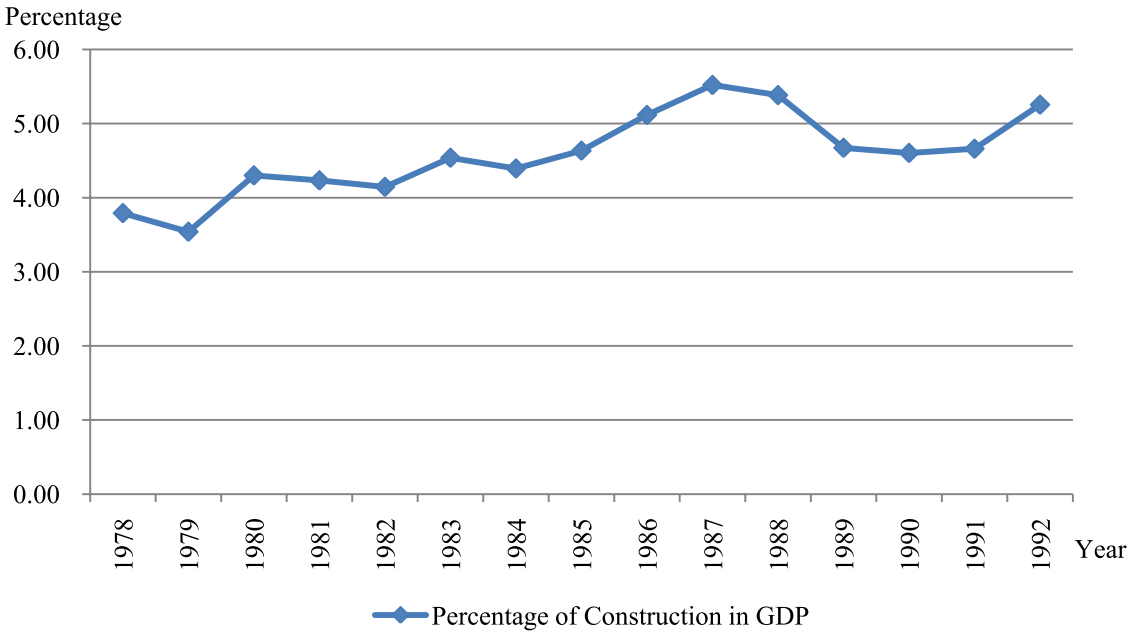


Figure 5.1.3 Percentage of Construction in GDP from 1978 to 1992

Table 5.1.4 Number of Employees and Pieces of Equipment from 1978 to 1992

Year	Number of Employees (10,000)	Pieces of Equipment
1978	-	-
1979	-	-
1980	648.00	-
1981	-	-
1982	-	-
1983	-	-
1984	847.70	-
1985	911.50	-
1986	913.60	-
1987	945.30	-
1988	968.20	-
1989	928.20	-
1990	1,010.70	-
1991	1,058.30	2,528,110
1992	1,065.70	2,531,578
Average Growth Rate (%)	2.98	-

Note: Adapted from the China Statistical Yearbooks 1996 and 2008

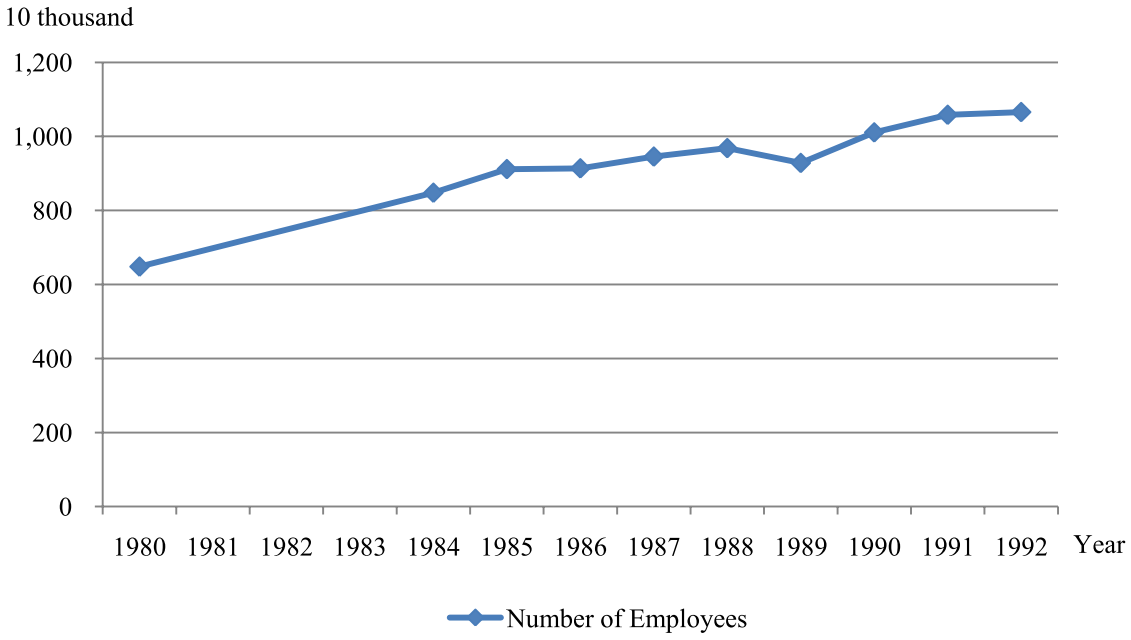


Figure 5.1.4 Number of Employees from 1978 to 1992

5.1.3 Market Structure

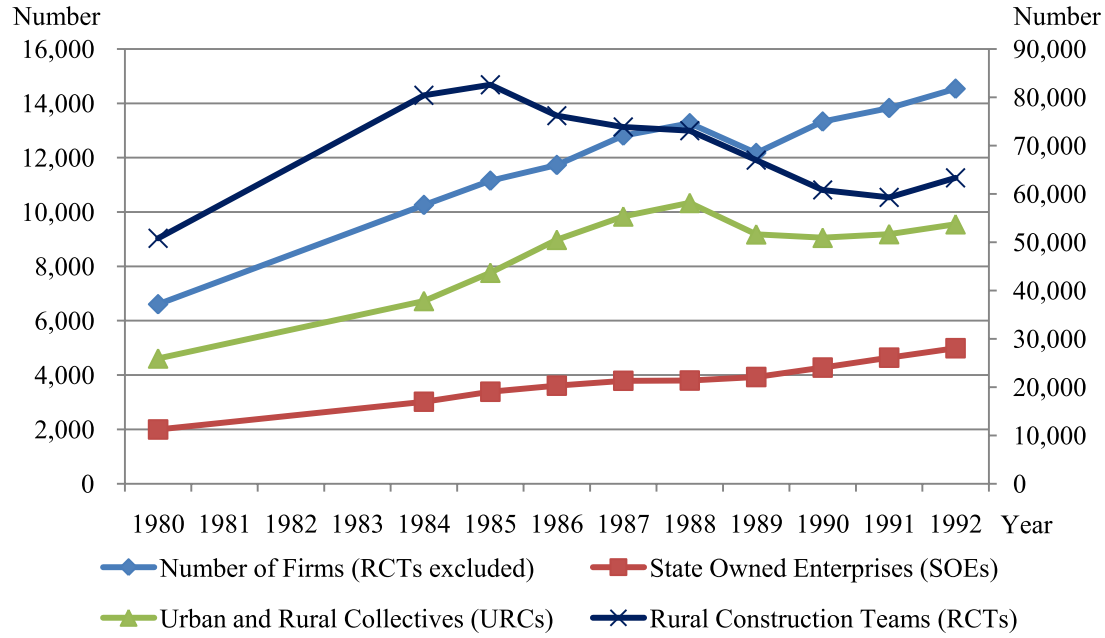
Table 5.1.5 shows the market structure of the Chinese construction industry from 1978 to 1992. However, data on the Chinese construction firms are not available for 1978, 1979, and from1981 to 1983. The average growth rates were calculated from 1984 to 1992. The number of state owned enterprises (SOEs) and urban and rural collectives (URCs) increased by 6.53% and 4.83%, respectively, while the number of rural construction teams (RCTs) dropped by 2.80%. At the same time, the number of RCTs was five times more than that of SOEs and URCs on an average basis, and RCTs were eight times as many as SOEs and URCs between 1980 and 1984. However, RCTs had a different growth trend than SOEs and URCs, as shown in Figure 5.1.5. The number of SOEs and URCs increased moderately until 1988, when the number of URCs experienced a deep drop, followed by a very slight increase, while the number of SOEs continued to grow. After the number of RCTs reached its peak in 1985 at more than 80,000, it began to decline continuously, and by 1991, it was at the level of 10 years before. Then it had a increase in the next year.

Table 5.1.5 Market Structure of the Chinese Construction Industry from 1978 to 1992

Year	Number of Firms (RCTs excluded)	State Owned Enterprises (SOEs)	Urban and Rural Collectives (URCs)	Rural Construction Teams (RCTs)
1978	-	-	-	-
1979	-	-	-	-
1980	6,604	1,996	4,608	50,800
1981	-	-	-	-
1982	-	-	-	-
1983	-	-	-	-
1984	10,258	3,017	6,724	80,400
1985	11,150	3,385	7,765	82,600
1986	11,729	3,608	8,977	76,186
1987	12,809	3,788	9,837	73,849
1988	13,265	3,798	10,336	73,090
1989	12,170	3,927	9,179	67,000
1990	13,327	4,275	9,052	60,818
1991	13,825	4,638	9,187	59,269
1992	14,536	4,985	9,551	63,321
Average Growth Rate (%)	4.60	6.53	4.83	-2.80

Note: Adapted from the China Statistical Yearbooks 1996 and 2008

Table 5.1.6 displays the Pearson correlation of the number of all types of firms. The Pearson correlation of the number of all firms and SOEs and URCs are 0.964 and 0.930 respectively and are significant at the 0.01 level, showing that during the first stage of reform they were strongly correlated. However, the Pearson correlation of the number of all firms and RCTs is only 0.146, representing that they were not correlated and RCTs did not have the same growth trend as SOEs and URCs.



Note: RCTs use the right scale; others use the left scale.

Figure 5.1.5 Market Structure of the Chinese Construction Industry from 1978 to 1992

Table 5.1.6 Pearson Correlation of Number of All Types of Firms from 1978 to 1992

		State Owned Enterprises (SOEs)	Urban and Rural Collectives (URCs)	Rural Construction Teams (RCTs)
Number of Firms	Pearson Correlation	.964*	.930*	.146
	Sig. (2-tailed)	.000	.000	.688
	N	10	10	10

*. Correlation is significant at the 0.01 level (2-tailed).

5.1.4 Summary

Between 1978 and 1992, the Chinese construction industry grew fast and steadily. However, all main indicators experienced a decline in 1989, indicating that the Chinese construction industry encountered a barrier in that year. The rules and regulations might be changed so that the construction firms would have to adopt the

new standards. The growth rates of value added and Gross Output Value of construction were higher than that of the number of employees and the number of firms, showing that individual employees and firms were creating more output value. The considerable decrease of the number of RCTs presents that during the first stage of reform, RCTs were in the difficult process of reforming under the new rules and regulations.

5.2 Development during the Second Stage of Reform from 1992 to 2001

5.2.1 GDP and Gross Output Value

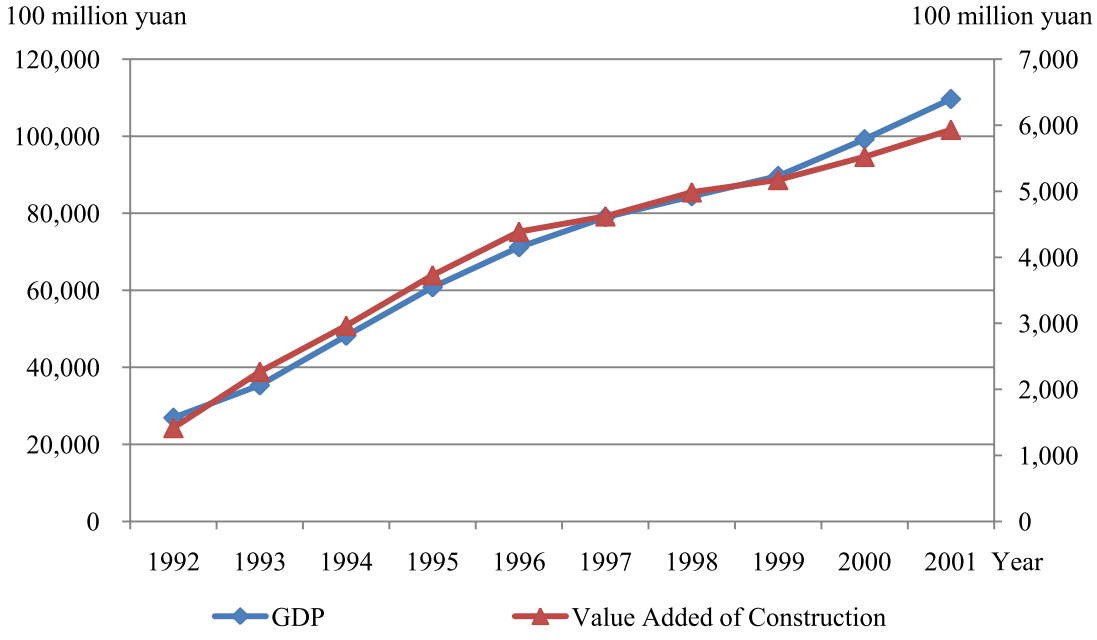
Between 1992 and 2001, China's GDP and value added of construction continued to grow at average growth rates of about 10%, as presented in Table 5.2.1. Gross Output Value of construction grew much faster than the national GDP with the average growth rate of 27.98%. Data on profit rate are available after 1994. Although the profit rate was very low in the mid 1990s, it had increased rapidly since 1998 and had grown by 58% in the next 3 years.

GDP and value added of construction shared almost the same continuous and steady growth tendency from 1992 to 2001, as presented in Figure 5.2.1. The Pearson correlation in Table 5.2.2 shows that GDP and value added of construction were highly correlated with a correlation of 0.992, which is significant at the 0.01 level.

Table 5.2.1 GDP and Gross Output Value from 1992 to 2001

Year	GDP (100 million yuan)	Value Added of Construction (100 million yuan)	Percentage of Construction in GDP (%)	Gross Output Value (100 million yuan)	Profit Rate (%)
1992	26,923.48	1,415.00	5.26	1,989.90	-
1993	35,333.92	2,266.46	6.41	3,253.53	-
1994	48,197.86	2,964.69	6.15	4,653.32	-
1995	60,793.73	3,728.85	6.13	5,793.75	1.28
1996	71,176.59	4,387.35	6.16	8,282.25	1.30
1997	78,973.03	4,621.61	5.85	9,126.48	1.20
1998	84,402.28	4,985.76	5.91	10,061.99	1.20
1999	89,677.05	5,172.10	5.77	11,152.86	1.40
2000	99,214.55	5,522.29	5.57	12,497.60	1.50
2001	109,655.17	5,931.67	5.41	15,361.56	1.90
Average Growth Rate (%)	10.37	10.20	-	27.98	-

Note: Adapted from the China Statistical Yearbooks 1996 through 2002, and 2008



Note: GDP uses the left scale; Value Added of Construction uses the right scale.

Figure 5.2.1 GDP and Value Added of Construction from 1992 to 2001

Table 5.2.2 Pearson Correlation of GDP and Value Added of Construction from 1992 to 2001

		Value Added of Construction
GDP	Pearson Correlation	.992*
	Sig. (2-tailed)	.000
	N	10

*. Correlation is significant at the 0.01 level (2-tailed).

Compared with that of value added of construction, the growth of Gross Output Value was much faster, as shown in Figure 5.2.2. By 2001, Gross Output Value was almost eight times what it was 10 years before, while value added of construction was only four times. Although having different growth rates, they were still strongly correlated. Their Pearson correlation is 0.972 and is significant at the 0.01 level (see Table 5.2.3).

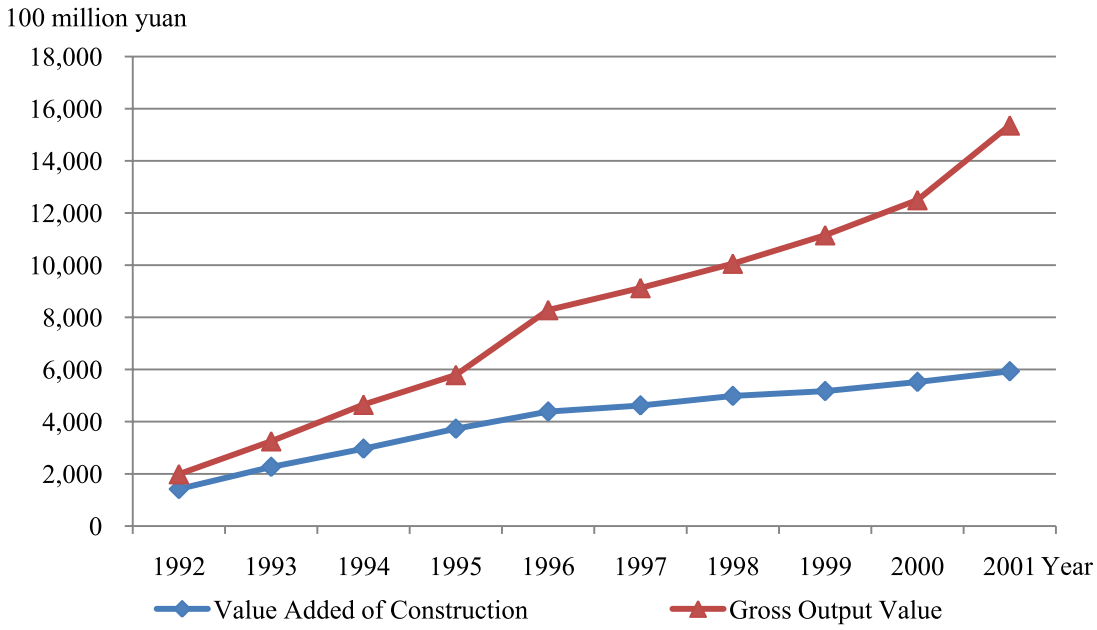


Figure 5.2.2 Value Added of Construction and Gross Output Value from 1992 to 2001

Table 5.2.3 Pearson Correlation of Value Added of Construction and Gross Output Value from 1992 to 2001

		Gross Output Value
Value Added of Construction	Pearson Correlation	.972*
	Sig. (2-tailed)	.000
	N	10

*. Correlation is significant at the 0.01 level (2-tailed).

Figure 5.2.3 illustrates the percentage of construction in GDP from 1992 to 2001. It surged sharply and reached the peak of 6.41% in 1993, then declined gradually each year, falling back to 5.41% in 2001.

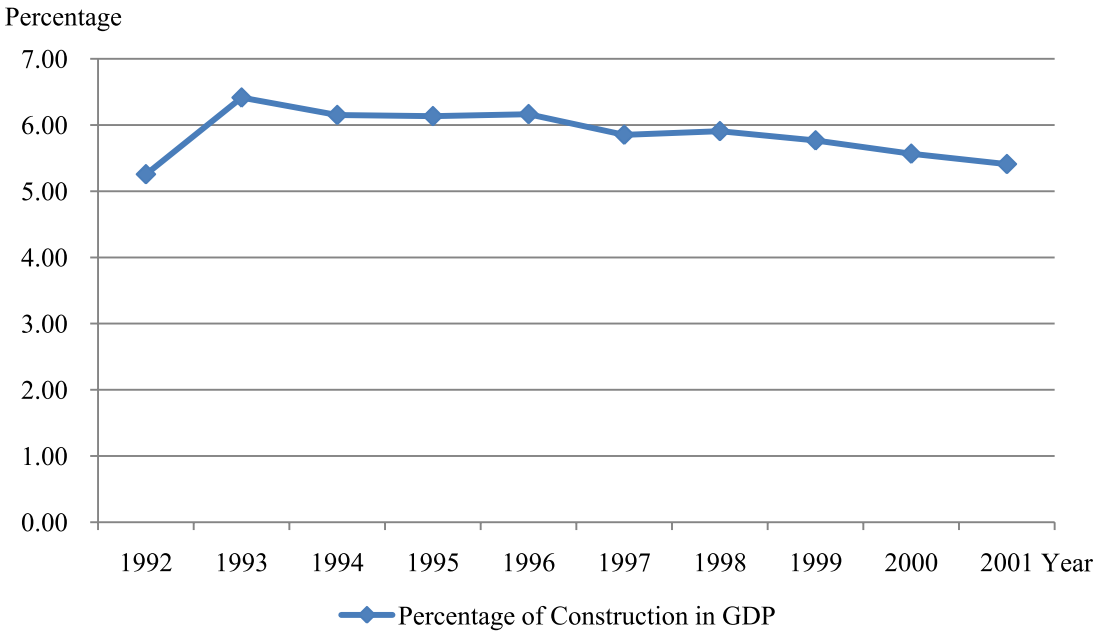


Figure 5.2.3 Percentage of Construction in GDP from 1992 to 2001

The profit rate of the Chinese construction industry from 1995 to 2001 is depicted in Figure 5.2.4. After decreasing slightly to 1.20% in 1998, the profit rate

ascended continuously and moderately each year and reached the peak of 1.90% in 2001. Although the profit rate was still relatively low, this growth trend suggests that the Chinese construction industry was reforming from a non-profit and planned industry into a profit-oriented free market.

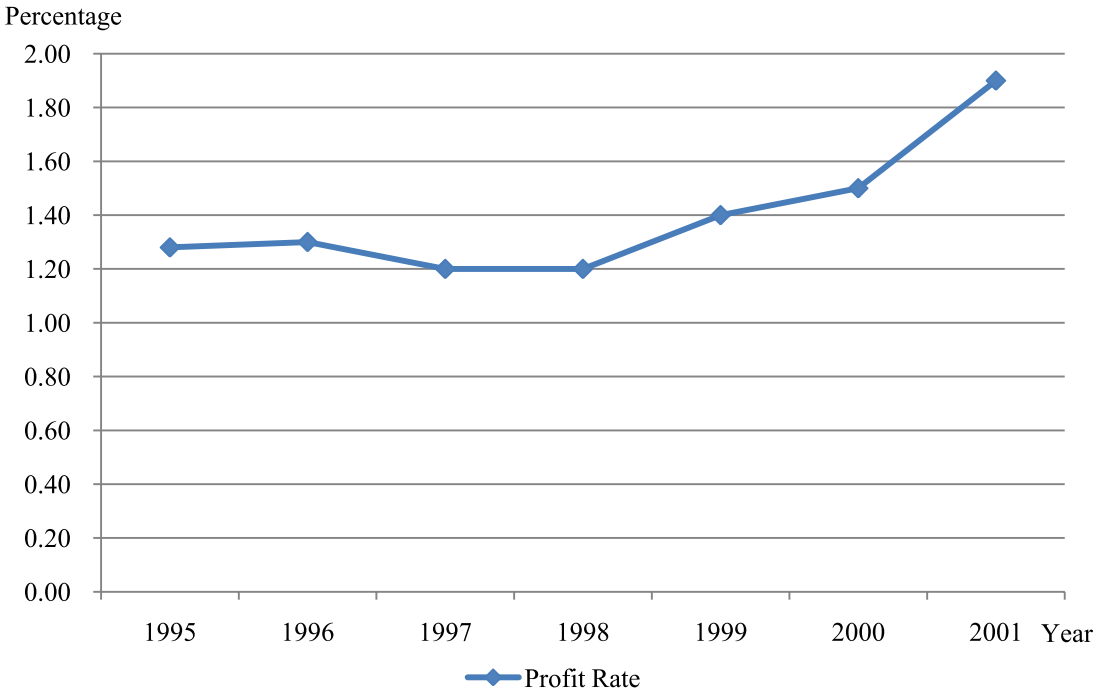


Figure 5.2.4 Profit Rate of Construction Industry from 1995 to 2001

5.2.2 Employees and Equipment

The average growth rates of the number of employees and pieces of equipment from 1992 to 2001 were similar to that of the economic indicators of the construction industry, as displayed in Table 5.2.4. The pieces of equipment increased faster than the number of employees, indicating that the construction industry was gradually

reforming from a labor intensive industry into a high technology and advanced equipment based industry.

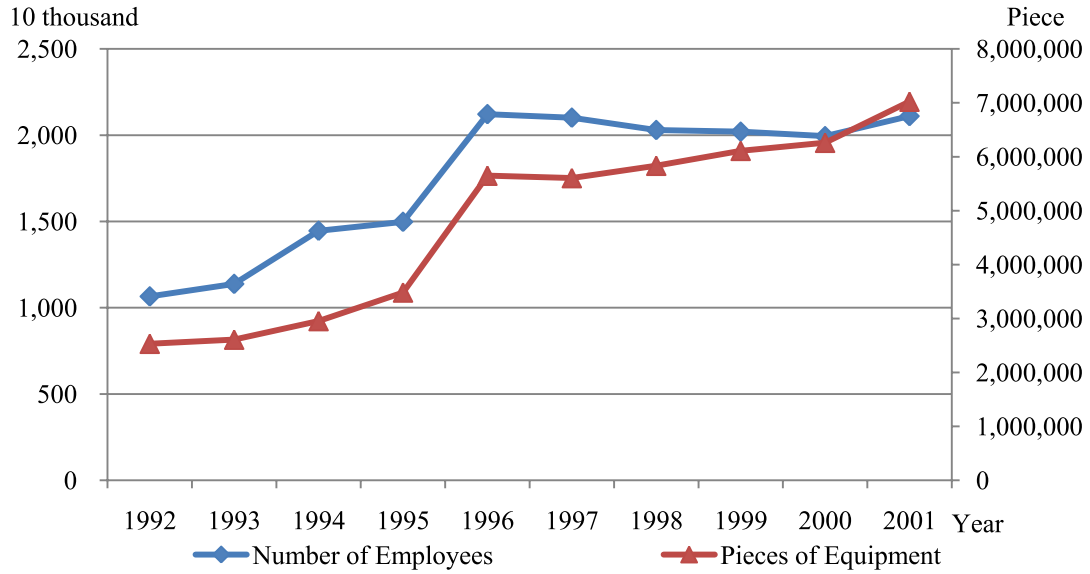
Table 5.2.4 Number of Employees and Pieces of Equipment from 1992 to 2001

Year	Number of Employees (10,000)	Pieces of Equipment
1992	1,065.70	2,531,578
1993	1,138.10	2,608,091
1994	1,445.90	2,952,629
1995	1,497.87	3,482,784
1996	2,121.87	5,649,612
1997	2,101.51	5,604,603
1998	2,029.99	5,833,748
1999	2,020.13	6,110,175
2000	1,994.30	6,259,885
2001	2,110.66	7,022,174
Average Growth Rate (%)	7.95	11.92

Note: Adapted from the China Statistical Yearbooks 1996 and 2008

The number of employees and pieces of equipment had the same developing trend before 1997, which increased gradually in the first 4 years and then rocketed by 41.66% and 62.22% respectively in 1996, followed by a slight drop in the next year (see Figure 5.2.5). After that the number of employees declined continuously and slightly, followed by a small rise in 2001, while the pieces of equipment changed to climb steadily in the following years. Although the ends of the two lines are different, the Pearson correlation still shows a strong correlation between them, as presented in Table 5.2.5. The Pearson correlation between number of employees and pieces of

equipment is 0.953 and is significant at the 0.01 level.



Note: Number of Employees uses the left scale; Pieces of Equipment use the right scale.

Figure 5.2.5 Number of Employees and Pieces of Equipment from 1992 to 2001

Table 5.2.5 Pearson Correlation of Number of Employees and Pieces of Equipment from 1992 to 2001

		Pieces of Equipment
Number of Employees	Pearson Correlation	.953*
	Sig. (2-tailed)	.000
	N	10

*. Correlation is significant at the 0.01 level (2-tailed).

5.2.3 Market Structure

5.2.3.1 Number of Firms

Table 5.2.6 shows the market structure of the Chinese construction industry in terms of the number of firms from 1992 to 2001. Data on RCTs are available until 1995 and

data on firms funded by Hong Kong, Macao, Taiwan, and overseas companies, and other types of domestic funded firms are available from 1995. The total number of firms continued to grow at the average rate of 14.63%. The number of SOEs increased much more slowly than other domestic funded firms at the average growth rate of 6.48%. URCs grew rather gradually at the average rate of 11.15%, but experienced deep rising and falling. Construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies accounted for a very small share of the construction market. However, they had different growth trends. Construction firms funded by Hong Kong, Macao, and Taiwan companies grew steadily at the average growth rate of 11.96%. The number of firms funded by overseas companies, on the other hand, decreased slightly on an average basis. Other types of domestic funded construction firms were making huge progress during the second stage of reform at the average growth rate of 90.66%. The growth rate in 1996 even reached 292.50%, suggesting that other types of domestic funded firms started to boom at a very high rate.

Figure 5.2.6 presents the market structure of the Chinese construction industry in terms of the number of firms expressed in percentage from 1995 to 2001. The market share of SOEs and URCs both decreased dramatically by about 10% and 20%, respectively, while the share of other types of domestic funded firms increased

Table 5.2.6 Market Structure (Number of Firms) of the Chinese Construction Industry from 1992 to 2001

Year	Number of Firms (RCTs excluded)	State Owned Enterprises (SOEs)	Urban and Rural Collectives (URCs)	Rural Construction Teams (RCTs)	Funded by Hong Kong, Macao and Taiwan Companies	Foreign Funded Firms	Other Types of Domestic Firms
1992	14,536	4,985	9,551	63,321	-	-	-
1993	20,998	6,363	14,130	70,486	-	-	-
1994	23,315	7,251	15,196	69,842	-	-	-
1995	24,133	7,531	15,348	71,017	329	312	613
1996	41,364	9,109	29,044	-	417	388	2,406
1997	44,017	9,650	29,872	-	491	454	3,550
1998	45,634	9,458	28,410	-	629	337	6,800
1999	47,234	9,394	27,197	-	664	341	9,638
2000	47,518	9,030	24,756	-	635	319	12,778
2001	45,893	8,264	19,096	-	622	274	17,637
Average Growth Rate (%)	14.63	6.48	11.15	-	11.96	-0.63	90.66

Note: Adapted from the China Statistical Yearbooks 1996 and 2008

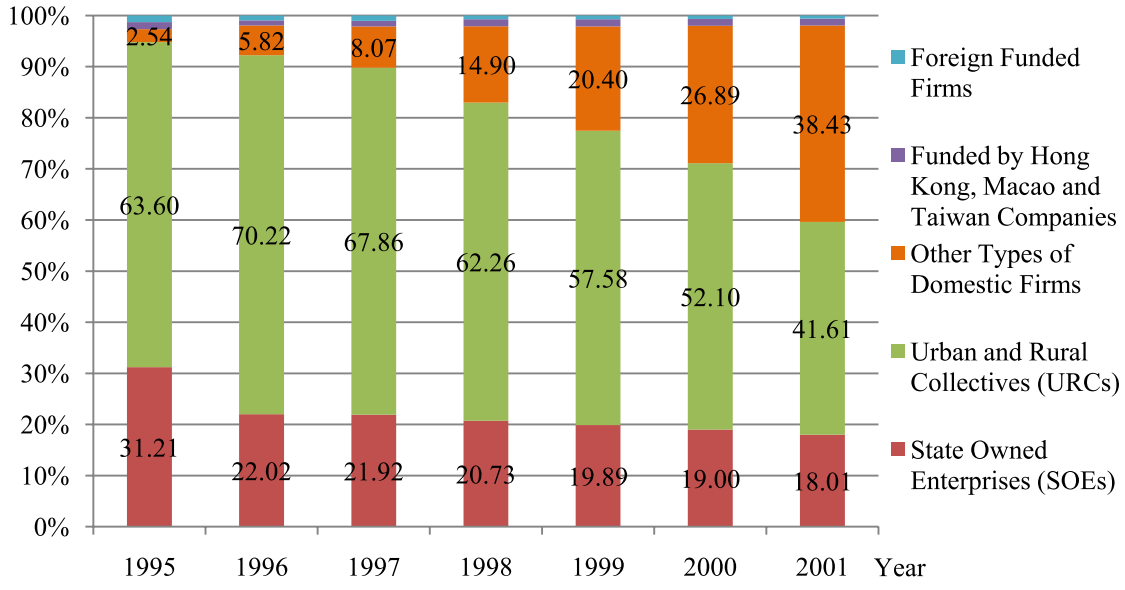


Figure 5.2.6 Market Structure (Number of Firms) of the Chinese Construction Industry Expressed in Percentage from 1995 to 2001

by 35%. The market share of the construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies was relatively small. The market share of the construction firms funded by Hong Kong, Macao, and Taiwan companies changed from 1% to 2%; the market share of foreign funded firms dropped a little from 1.29% to below 1%.

Although the number of SOEs increased or decreased slowly and slightly over the ten year period, it had a strong correlation with the number of all firms, as displayed in Table 5.2.7. The Pearson correlation of the number of all firms and SOEs is 0.926 and is significant at the 0.01 level. The Pearson correlation of the number of all firms and URCs (0.884, significant at the 0.01 level) is not as strong as that of all firms and SOEs, largely due to the difference of the growth between the number of all firms and URCs from 1997 to 2001. The fast growth of other types of domestic funded firms minimally matched the growth tendency of the number of all the firms, making the Pearson correlation 0.644. This indicates that the number of all firms and other types of domestic funded firms was not closely correlated during the second stage of reform. While the Pearson correlation of the number of all firms and firms funded by Hong Kong, Macao, and Taiwan companies is 0.865 and is significant at the 0.05 level, the Pearson correlation of the number of all firms and foreign funded firms is only 0.107 and is not significant. This represents that unlike that of firms

funded by Hong Kong, Macao, and Taiwan companies, the growth tendency of foreign funded firms was not correlated with that of all firms, which indicates that fewer foreign funded firms were conducting business in the Chinese construction market from 1992 to 2001.

Table 5.2.7 Pearson Correlation of Number of All Types of Firms from 1992 to 2001

		SOEs	URCs	Other Types of Domestic Firms	Firms Funded by Hong Kong, Macao, and Taiwan Companies	Foreign Funded Firms
Number of Firms	Pearson Correlation	.926**	.884**	.644	.865*	.107
	Sig. (2-tailed)	.000	.001	.118	.012	.820
	N	10	10	7	7	7

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

5.2.3.2 Gross Output Value

Table 5.2.8 shows the market structure of the Chinese construction industry in terms of Gross Output Value from 1995 to 2001. The Gross Output Value of SOEs increased at the lowest average growth rate of 6.59% among all types of construction firms, and the market share of SOEs continued to drop dramatically from 63.35% to 34.91%. The Gross Output Value of URCs remained generally stable except for a huge rise of 94.56% in 1995. The Gross Output Value of firms funded by Hong Kong, Macao and Taiwan, and overseas companies grew steadily at the average rates of 21.83% and 16.08%, respectively, even though the number of foreign funded firms was actually

decreasing slightly. The Gross Output Value of other types of domestic funded firms rocketed at a similar rate as their number did, at the average growth rate of 91.49%, and overtook SOEs and became the largest contributor to the overall Gross Output Value in the Chinese construction industry in 2001.

Table 5.2.8 Market Structure (Gross Output Value) of the Chinese Construction Industry from 1995 to 2001 (100 million yuan)

Year	Gross Output Value	State Owned Enterprises (SOEs)	Urban and Rural Collectives (URCs)	Funded by Hong Kong, Macao and Taiwan Companies	Foreign Funded Firms	Other Types of Domestic Firms
1995	5,793.75	3,670.25	1,899.47	33.60	33.19	154.40
1996	8,282.25	4,160.21	3,695.68	46.85	50.51	329.00
1997	9,126.48	4,526.52	3,925.81	63.72	70.49	539.95
1998	10,061.99	4,571.44	3,793.17	91.94	62.52	1,542.92
1999	11,152.86	4,861.38	3,786.35	91.97	64.43	2,348.73
2000	12,497.60	5,053.79	3,682.53	99.18	67.49	3,594.61
2001	15,361.56	5,362.81	3,327.55	102.55	73.06	6,495.59
Average Growth Rate (%)	18.20	6.59	14.14	21.83	16.08	91.49

Note: Adapted from the China Statistical Yearbook 2008

The market structure of the Chinese construction industry in terms of Gross Output Value expressed in percentage from 1995 to 2001 is shown in Figure 5.2.7. During this stage, the market share of SOEs dropped considerably by nearly 30% and that of URCs dropped by 10%. On the contrary, the market share of other types of domestic funded firms rocketed by 40%, becoming the major contributor to Gross

Output Value in 2001. The market share of the construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies was constantly below 1%.

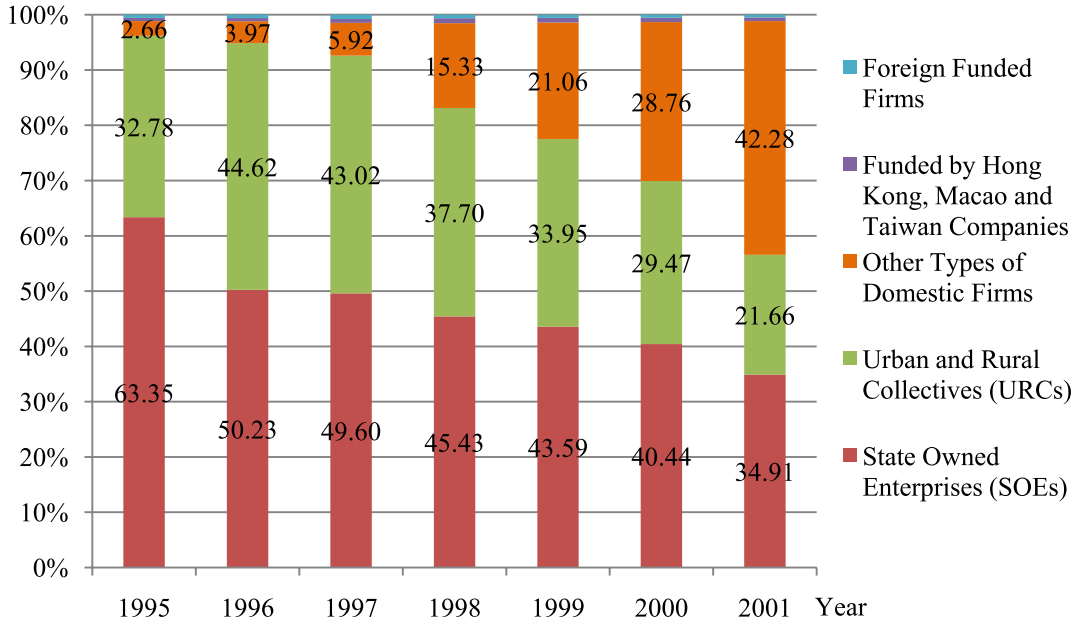


Figure 5.2.7 Market Structure (Gross Output Value) of
the Chinese Construction Industry Expressed in Percentage from 1995 to 2001

Through the comparison of the market structure expressed in percentage in terms of both the number of firms and Gross Output Value as presented in Figure 5.2.6 and Figure 5.2.7, it is clear that although URCs had the largest market share in terms of number each year, they produced the Gross Output Value which was actually half the percentage that their number accounted for. On the contrary, the percentage of the Gross Output Value that SOEs made doubled that of their number each year, which means that the output value of individual SOEs was about four times that of individual URCs. Other types of domestic funded firms had a similar percentage for

both their number and Gross Output Value, suggesting that the output value of individual other types of domestic funded firms was right in the middle between that of SOEs and URCs. Therefore, the ratio of the output value of individual URCs, other types of domestic funded firms, and SOEs can be concluded as about 1:2:4.

Table 5.2.9 presents the Pearson correlation of the Gross Output Value of all types of firms. The Gross Output Value of SOEs had the strongest correlation among all types of firms, which is 0.980 and is significant at the 0.01 level. It shows that although the Gross Output Value of SOEs increased slowly, its growth tendency was still strongly correlated with the development of the Chinese construction industry. On the other hand, URCs were losing their influence in contributing to Gross Output Value. The Pearson correlation is only 0.462 and is not significant. The Gross Output Value of other types of domestic funded firms was the second most strongly correlated with that of the construction industry. The Pearson correlation of them is 0.949 and is significant at the 0.01 level, indicating that other types of domestic funded firms had become an indispensable section of the Chinese construction industry. Although the Gross Output Values of the construction firms funded by Hong Kong, Macao and Taiwan companies and foreign funded firms were the minor part of the construction industry, the Pearson correlation between them and all firms is 0.903 at the 0.01 significant level, and 0.826 at the 0.05 significant level, respectively,

representing that they were also closely correlated with the development of the Chinese construction industry.

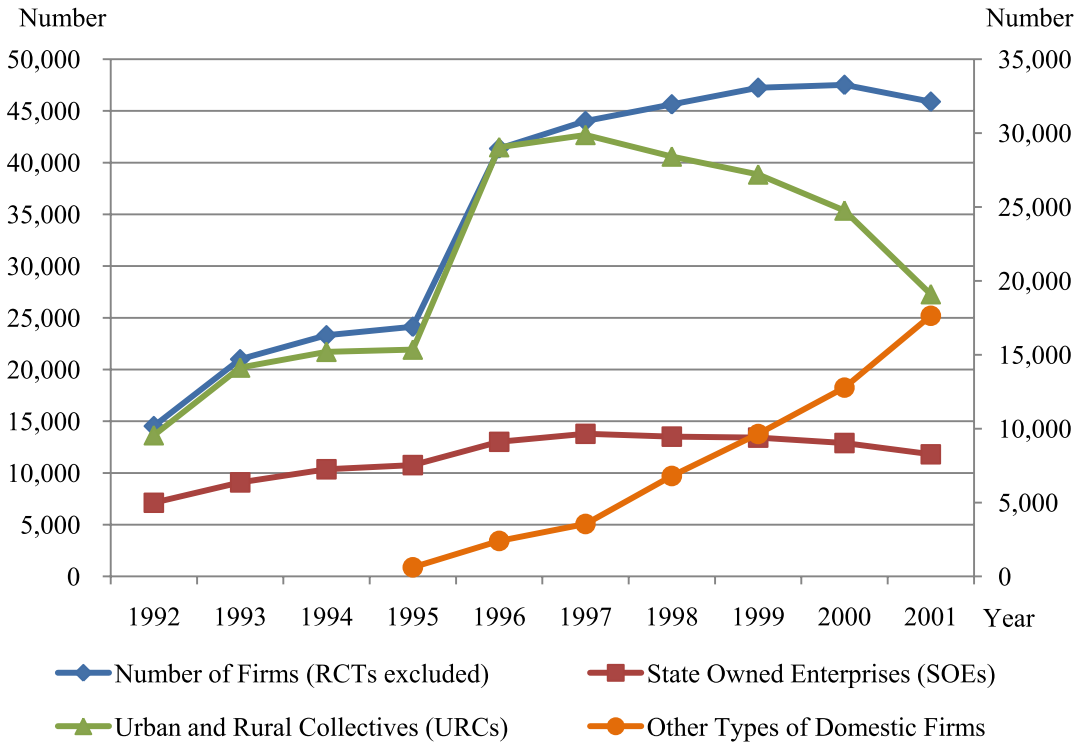
Table 5.2.9 Pearson Correlation of Gross Output Value of All Types of Firms from 1992 to 2001

		SOEs	URCs	Other Types of Domestic Firms	Firms Funded by Hong Kong, Macao, and Taiwan Companies	Foreign Funded Firms
Gross Output Value of Firms	Pearson Correlation	.980**	.462	.949**	.903**	.826*
	Sig. (2-tailed)	.000	.297	.001	.005	.022
	N	7	7	7	7	7

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

5.2.3.3 Growth of Domestic Funded Firms

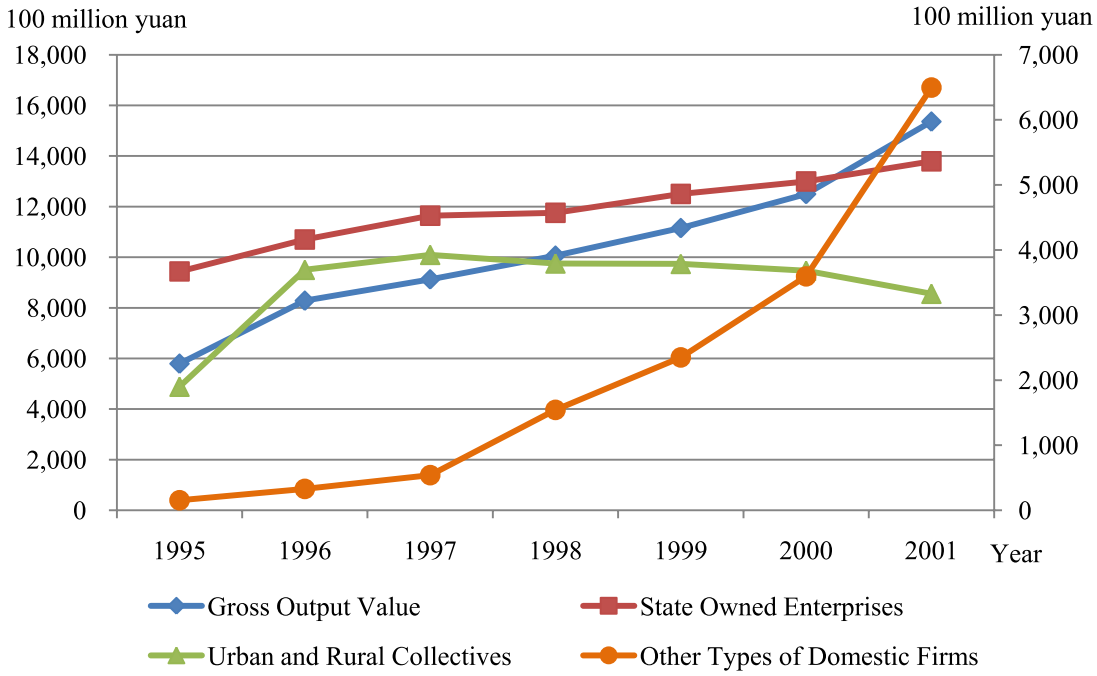
Figure 5.2.8 presents the growth of domestic funded construction firms in terms of the number of firms from 1992 to 2001. The number of all firms grew gradually until 1996, when it rocketed at the growth rate of 71.4%, then continued to increase moderately, followed by a small drop in 2001. The number of URCs shared the same growth trend with that of all firms before 1997, after which it decreased gradually each year. The number of SOEs rose in the first six years and then fell in the next four years very slowly. The number of other types of domestic funded construction firms surged appreciably each year after its debut in 1995, reaching almost the same number as URCs in 2001. This indicates that after 1997, more URCs chose to reform into other types of construction firms, which can fit the business environment better.



Note: Number of Firms uses the left scale; other uses the right scale.

Figure 5.2.8 Growth of Domestic Funded Firms
Measured in Number of Firms from 1992 to 2001

Figure 5.2.9 illustrates the growth of domestic funded construction firms in terms of Gross Output Value from 1995 to 2001. The Gross Output Value of SOEs grew very gradually while that of URCs increased considerably in 1996, reaching the peak in 1997, and fell back gradually in each following year. On the other hand, the Gross Output Value of other types of domestic funded firms climbed appreciably after 1997, overtaking that of URCs in 2000 and becoming the largest section in the Chinese construction industry in 2001.

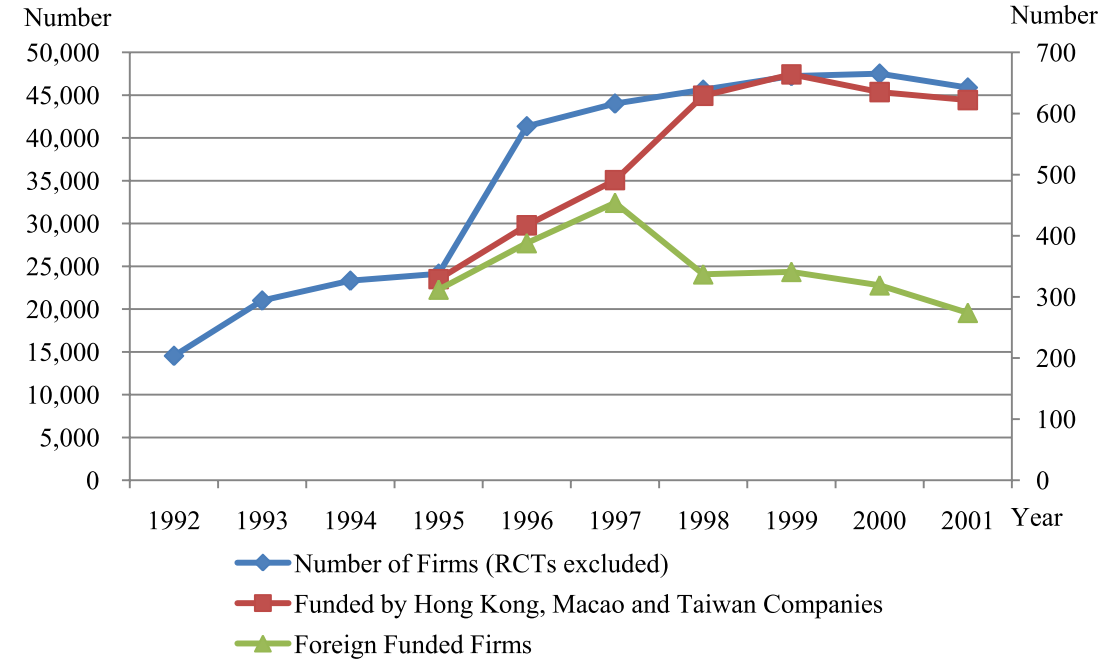


Note: Gross Output Value uses the left scale; others use the right scale.

Figure 5.2.9 Growth of Domestic Funded Firms Measured in Gross Output Value from 1995 to 2001

5.2.3.4 Growth of Foreign Funded Firms

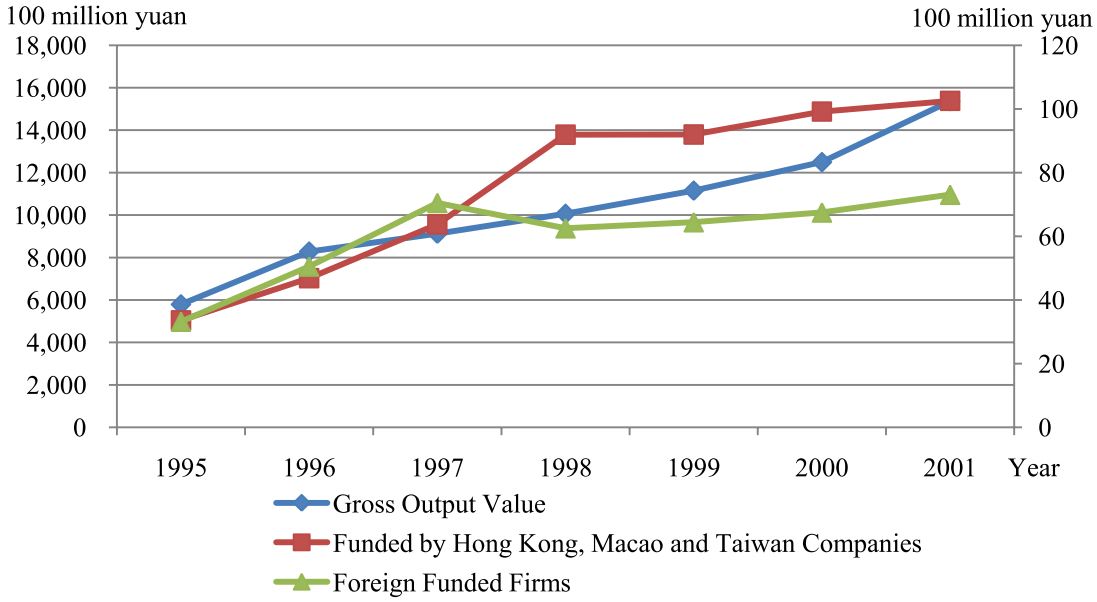
The growth of the construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies in terms of the number of firms from 1992 to 2001 is presented in Figure 5.2.10. The number of construction firms funded by Hong Kong, Macao, and Taiwan companies grew fast and continuously until 1999, and then dropped slightly in the next two years. On the other hand, the number of foreign funded construction firms declined continuously after it reached the summit in 1997. This suggests that after 1997 many foreign funded construction firms were struggling and almost 40% of them withdrew from the Chinese market.



Note: Number of Firms uses the left scale; others use the right scale.

Figure 5.2.10 Growth of Foreign Funded Firms Measured in Number of Firms from 1992 to 2001

The growth of the construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies in terms of Gross Output Value from 1995 to 2001 is depicted in Figure 5.2.11. The tendency of the Gross Output Value of construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies was generally similar to that of the number of these firms before 1998. The Gross Output Value of these construction firms increased slightly. However, the difference between the Gross Output Value of these firms was considerable in 2001, like that of their number shown in Figure 5.2.10. Although about 40% of the foreign funded firms had quit the Chinese market by 2001, the remaining were successful in making more profit.



Note: Gross Output Value uses the left scale; others use the right scale.

Figure 5.2.11 Growth of Foreign Funded Firms Measured in Gross Output Value from 1995 to 2001

5.2.4 Summary

The Chinese construction industry continued to grow at a fast rate between 1992 and 2001. Gross Output Value climbed rapidly and the profit rate was also rising, representing that the Chinese construction industry was reforming from a non-profit and planned industry into a profit-oriented free market. At the same time, the percentage of construction in GDP declined steadily and smoothly. Data analyses of employees, equipment, and firms indicate that between 1995 and 1996, the Chinese construction firms grew appreciably in all the above aspects. Although the number of URCs was twice that of SOEs each year, the latter were the largest Gross Output Value contributor before 2001. The ratio of the output value of individual URCs,

other types of domestic funded firms, and SOEs was about 1:2:4. Other types of domestic funded construction firms grew greatly after 1995; on the other hand, many foreign funded firms were struggling after their peak in 1997 and about 40% of them had quit by 2001, reflecting that they were not yet able to adapt well to the business environment of the Chinese construction market during this period.

5.3 Development during the Third Stage of Reform from 2001 to 2007

5.3.1 GDP and Gross Output Value

Table 5.3.1 presents the GDP and Gross Output Value of the Chinese construction industry from 2001 to 2007. In the last eight years, GDP and value added of construction grew steadily at almost the same average growth rate of 10%. At the same time, percentage of construction in GDP stayed rather stable around 5.50 %, reflecting that recently the Chinese construction industry was in a comparatively steadily developing stage. Gross Output Value had the average growth rate of 22.29%, slower than what it had in the previous stage, which was around 28%. The profit rate was increasing continuously, despite that it dropped slightly in 2004. The profit rate in 2007 had increased by 61.05% compared to 2001, demonstrating that the Chinese construction industry was successful in the process of reforming into a profit-oriented market.

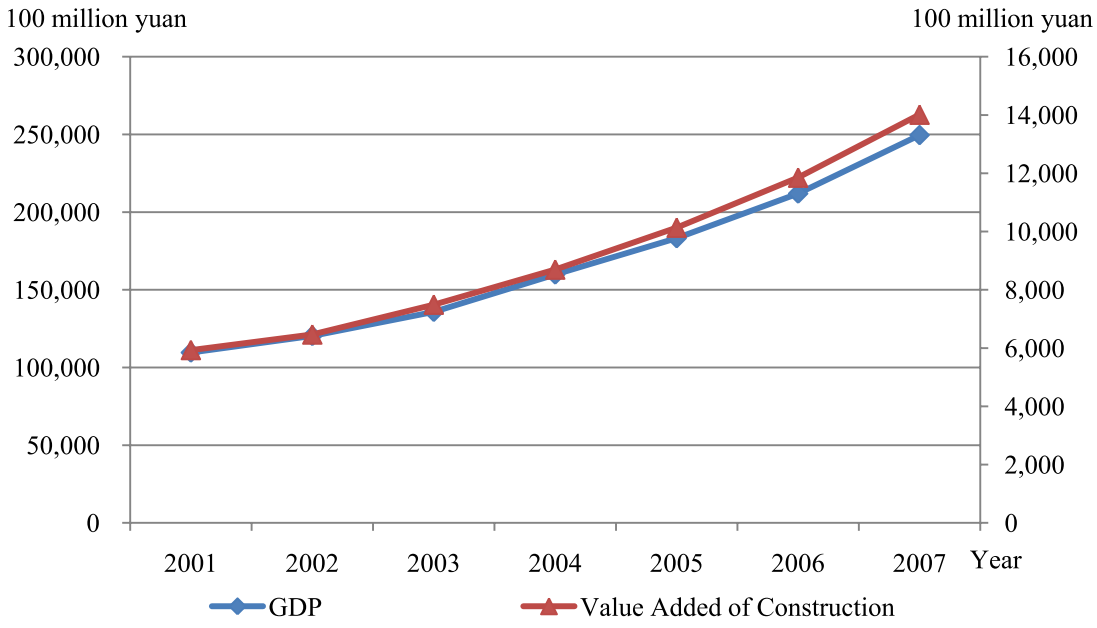
Table 5.3.1 GDP and Gross Output Value from 2001 to 2007

Year	GDP (100 million yuan)	Value Added of Construction (100 million yuan)	Percentage of Construction in GDP (%)	Gross Output Value (100 million yuan)	Profit Rate (%)
2001	109,655.17	5,931.67	5.41	15,361.56	1.90
2002	120,332.69	6,465.46	5.37	18,527.18	2.00
2003	135,822.76	7,490.78	5.52	23,083.87	2.30
2004	159,878.34	8,694.28	5.44	29,021.45	2.20
2005	183,217.40	10,133.80	5.51	34,552.10	2.62
2006	211,923.50	11,851.09	5.62	41,557.16	2.85
2007	249,529.90	14,014.10	5.60	51,043.71	3.06
Average Growth Rate (%)	10.20	10.66	-	22.29	-

Note: Adapted from the China Statistical Yearbooks 2002 through 2008

GDP and value added of construction increased moderately with very little difference from 2001 to 2007, as illustrated in Figure 5.3.1. The Pearson correlation of the two economic indicators even reaches 1.000 and is significant at the 0.01 level (see Table 5.3.2), demonstrating that the growth of GDP and value added of construction was generally synchronous.

Although the growth rates of value added of construction and Gross Output Value were different, as depicted in Figure 5.3.2, the Pearson correlation of these two indicators is 0.999 and is significant at the 0.01 level, showing that they also shared a synchronous growth trend, as presented in Table 5.3.3.



Note: GDP uses the left scale; Value Added of Construction uses the right scale.

Figure 5.3.1 GDP and Value Added of Construction from 2001 to 2007

Table 5.3.2 Pearson Correlation of GDP and Value Added of Construction from 2001 to 2007

		Value Added of Construction
GDP	Pearson Correlation	1.000*
	Sig. (2-tailed)	.000
	N	7

*. Correlation is significant at the 0.01 level (2-tailed).

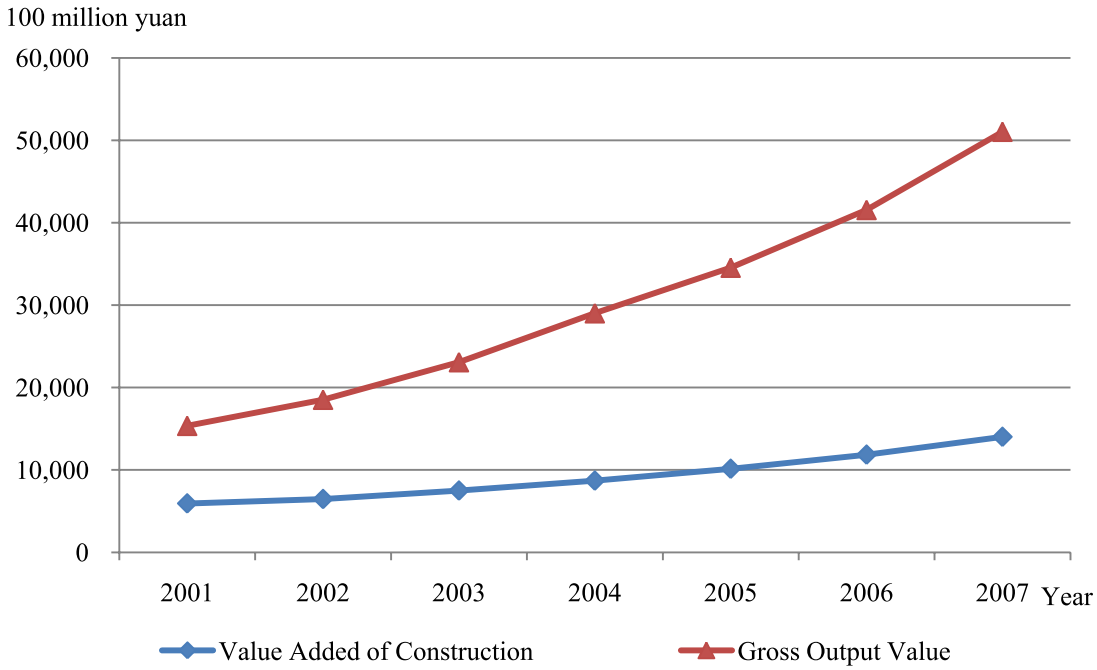


Figure 5.3.2 Value Added of Construction and Gross Output Value from 2001 to 2007

Table 5.3.3 Pearson Correlation of Value Added of Construction and Gross Output Value from 2001 to 2007

		Gross Output Value
Value Added of Construction	Pearson Correlation	.999*
	Sig. (2-tailed)	.000
	N	7

*. Correlation is significant at the 0.01 level (2-tailed).

Percentage of construction in GDP remained steady between 5% and 6% with the average of 5.50% from 2001 to 2007, as shown in Figure 5.3.3. This demonstrates that the Chinese construction industry was in a rather stably developing stage.

Figure 5.3.3 Percentage of Construction in GDP from 2001 to 2007

The profit rate of the construction industry from 2001 to 2007 is displayed in Figure 5.3.4. It continued to increase gradually except for a small drop in 2004. In 2007, the profit rate of the construction industry was higher than 3% for the first time, reflecting the success of the construction industry's reform into a profit-oriented market.

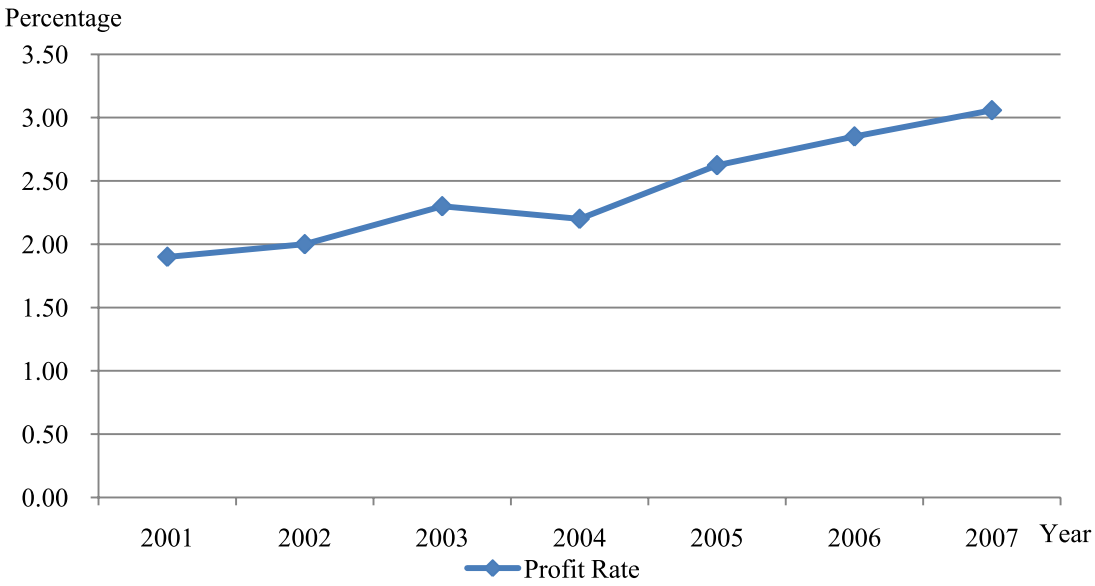


Figure 5.3.4 Profit Rate of Construction Industry from 2001 to 2007

5.3.2 Employees and Equipment

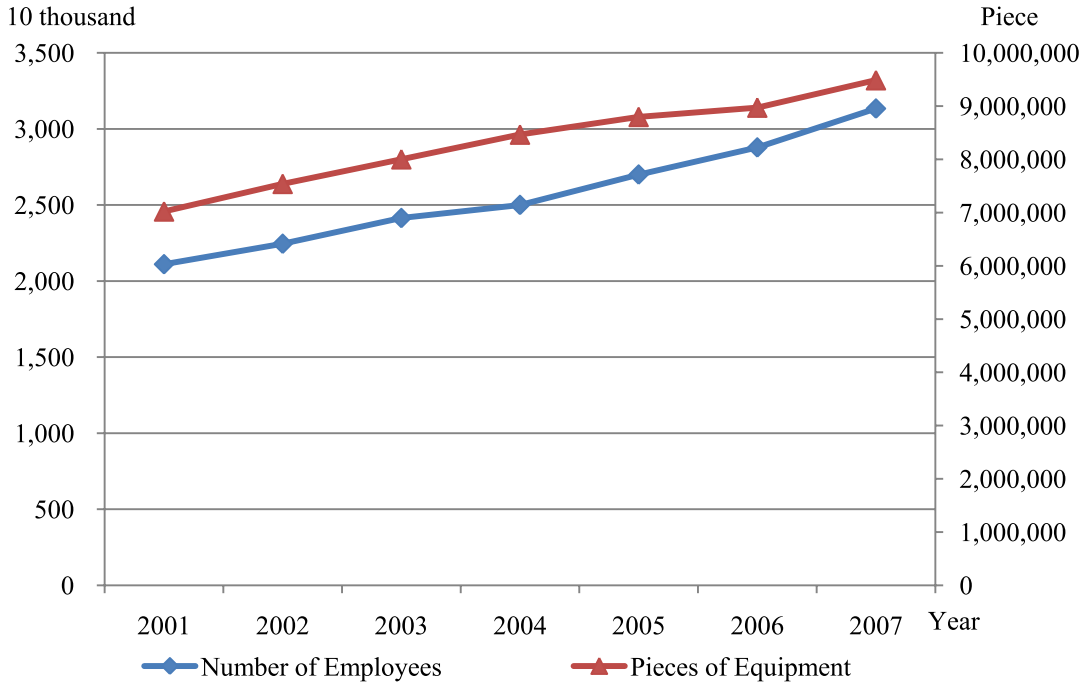
The number of employees and pieces of equipment from 2001 to 2007 were both increasing continuously and gradually with the average growth rates around 6% to 7% (see Table 5.3.4). In 2007, the number of employees exceeded 30 million and the pieces of equipment surpassed 9 million both for the first time, reflecting the fast and positive developing tendency and the successful and stable growth in the reform of the Chinese construction industry.

Figure 5.3.5 displays the number of employees and pieces of equipment from 2001 to 2007. The Pearson correlation in Table 5.3.5 indicates that they were closely correlated with the coefficient of 0.976 and the correlation is significant at the 0.01 level.

Table 5.3.4 Number of Employees and Pieces of Equipment from 2001 to 2007

Year	Number of Employees (10,000)	Pieces of Equipment
2001	2,110.66	7,022,174
2002	2,245.19	7,540,011
2003	2,414.27	8,001,782
2004	2,500.30	8,466,386
2005	2,699.92	8,798,527
2006	2,878.16	8,973,042
2007	3,133.71	9,487,515
Average Growth Rate (%)	6.68	6.16

Note: Adapted from the China Statistical Yearbook 2008



Note: Number of Employees uses the left scale; Pieces of Equipment use the right scale.

Figure 5.3.5 Number of Employees and Pieces of Equipment from 2001 to 2007

Table 5.3.5 Pearson Correlation of Number of Employees and Pieces of Equipment from 2001 to 2007

		Pieces of Equipment
Number of Employees	Pearson Correlation	.976*
	Sig. (2-tailed)	.000
	N	7

*. Correlation is significant at the 0.01 level (2-tailed).

5.3.3 Market Structure

5.3.3.1 Number of Firms

Table 5.3.6 presents the market structure of the Chinese construction industry in terms of the number of firms from 2001 to 2007. While the total number of construction firms increased by a small percentage, it is surprising to note that of the five main types of construction firms, three had been decreasing, including two traditional types - SOEs and URCs. The number of URCs was declining considerably at the average growth rate of -16.79%, while the number of SOEs was dropping at the average growth rate of -7.23%. The number of construction firms funded by Hong Kong, Macao and Taiwan companies had also been decreasing gradually. To the contrary, the number of foreign funded firms was increasing by a small amount. What should be noted most is that the number of other types of domestic funded firms had been climbing by a large percentage of 22.50% and accounted for the most important part in all types of construction firms during this period.

Table 5.3.6 Market Structure (Number of Firms) of the Chinese Construction Industry from 2001 to 2007

Year	Number of Firms	State Owned Enterprises (SOEs)	Urban and Rural Collectives (URCs)	Funded by Hong Kong, Macao and Taiwan Companies	Foreign Funded Firms	Other Types of Domestic Frims
2001	45,893	8,264	19,096	622	274	17,637
2002	47,820	7,536	13,177	632	279	26,196
2003	48,688	6,638	10,425	535	287	30,803
2004	59,018	6,513	8,959	511	386	42,649
2005	58,750	6,007	8,090	516	388	43,749
2006	60,166	5,555	7,051	479	370	46,711
2007	62,074	5,319	6,614	482	365	49,294
Average Growth Rate (%)	4.13	-7.23	-16.79	-3.69	2.80	22.50

Note: Adapted from the China Statistical Yearbook 2008

Figure 5.3.6 presents the market structure of the Chinese construction industry in terms of the number of firms expressed in percentage from 2001 to 2007. The market share of SOEs continuously decreased by about 10%, while that of URCs declined appreciably by about 30%. On the other hand, the market share of other types of domestic funded firms surged by almost 40%. The market share of the construction firms funded by Hong Kong, Macao, and Taiwan companies dropped slightly below 1%, and that of foreign funded firms remained constantly below 1%.

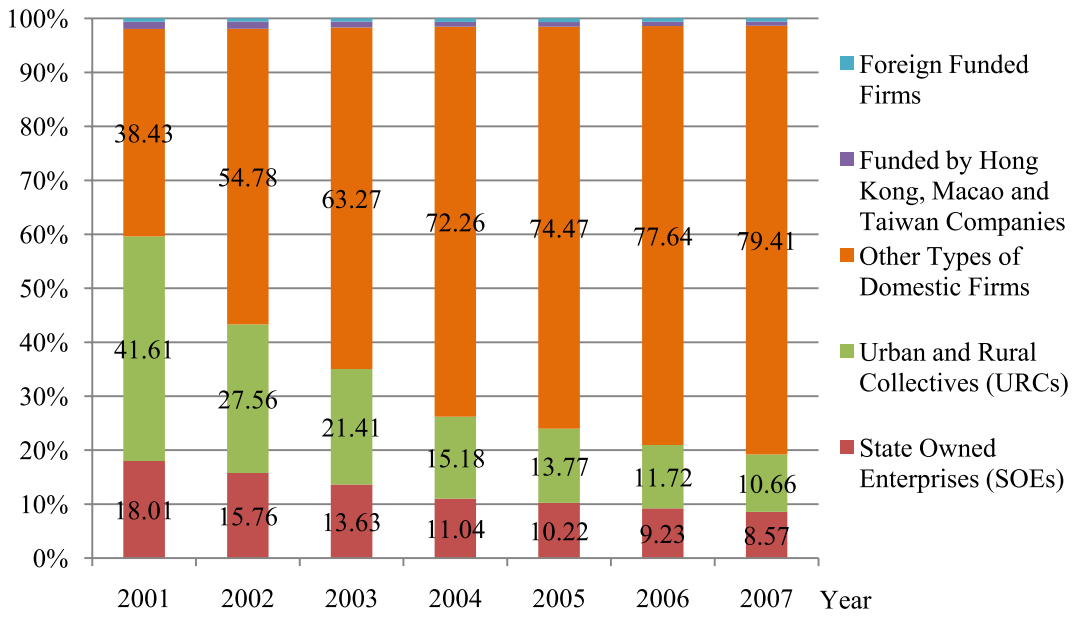


Figure 5.3.6 Market Structure (Number of Firms) of
the Chinese Construction Industry Expressed in Percentage from 2001 to 2007

The Pearson correlation of the number of all types of firms is displayed in Table 5.3.7. While the number of SOEs and URCs were both decreasing, the Pearson correlation of the number of all firms and SOEs is -0.905 and is significant at the 0.01 level, and the Pearson correlation of the number of all firms and URCs is -0.873 and is significant at the 0.05 level, showing that there were strong negative correlations between them and the number of all firms. On the other hand, the Pearson correlation of the number of all firms and other types of domestic funded firms is 0.977 and is significant at the 0.01 level, representing the close correlation between them during this period. The number of all firms and firms funded by Hong Kong, Macao, and Taiwan companies is negatively correlated at -0.896 and the correlation is significant

at the 0.01 level. Conversely, the Pearson correlation of the number of all firms and foreign funded firms is 0.952 and is significant at the 0.01 level, representing a strong correlation despite that the number of foreign funded firms was relatively rather small. It is interesting to note that the number of these two non-domestic funded types of construction firms have had entirely opposite directions in their development in recent years.

Table 5.3.7 Pearson Correlation of Number of All Types of Firms from 2001 to 2007

		SOEs	URCs	Other Types of Domestic Firms	Firms Funded by Hong Kong, Macao, and Taiwan Companies	Foreign Funded Firms
Number of Firms	Pearson Correlation	-.905**	-.873*	.977**	-.896**	.952**
	Sig. (2-tailed)	.005	.010	.000	.006	.001
	N	7	7	7	7	7

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

5.3.3.2 Gross Output Value

Table 5.3.8 shows the market structure of the Chinese Construction Industry in terms of Gross Output Value from 2001 to 2007. The market share of SOEs still grew steadily at the average growth rate of 10.50% despite that they were no longer the main contributor. However, the Gross Output Value of URCs failed to make any increase and dropped a little at the average growth rate of -1.09%. The Gross Output Value of foreign funded firms climbed at an average growth rate almost twice that of

the firms funded by Hong Kong, Macao and Taiwan companies, and had surpassed it since 2003. This indicates that contrary to the previous stage, foreign funded firms were able to adapt to the business environment better than the firms funded by Hong Kong, Macao and Taiwan companies after China's WTO accession. Other types of domestic funded firms grew the fastest among all types of construction firms at the average growth rate of 42.78% and had the largest market share each year.

Table 5.3.8 Market Structure (Gross Output Value) of the Chinese Construction Industry from 2001 to 2007 (100 million yuan)

Year	Gross Output Value	State Owned Enterprises (SOEs)	Urban and Rural Collectives (URCs)	Funded by Hong Kong, Macao and Taiwan Companies	Foreign Funded Firms	Other Types of Domestic Firms
2001	15,361.56	5,362.81	3,327.55	102.55	73.06	6,495.59
2002	18,527.18	5,582.86	3,338.50	113.87	91.38	9,400.56
2003	23,083.87	6,060.23	3,270.73	123.71	129.39	13,499.81
2004	29,021.45	-	-	-	-	-
2005	34,552.10	8,432.03	2,815.20	172.54	249.03	22,883.29
2006	41,557.16	9,218.56	2,904.48	240.52	274.87	28,918.73
2007	51,043.71	10,630.90	3,153.65	281.95	396.32	36,580.90
Average Growth Rate (%)	22.29	10.50	-1.09	16.57	29.29	42.78

Note: Adapted from the China Statistical Yearbook 2008

Figure 5.3.7 displays the market structure of the Chinese construction industry in terms of Gross Output Value expressed in percentage from 2001 to 2007. The market share of SOEs and URCs continued to decline, both by about 15%. On the other hand, the market share of other types of domestic funded firms increased

considerably again by nearly 30% and reached over 70% in 2007. The market share of the construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies was still below 1%.

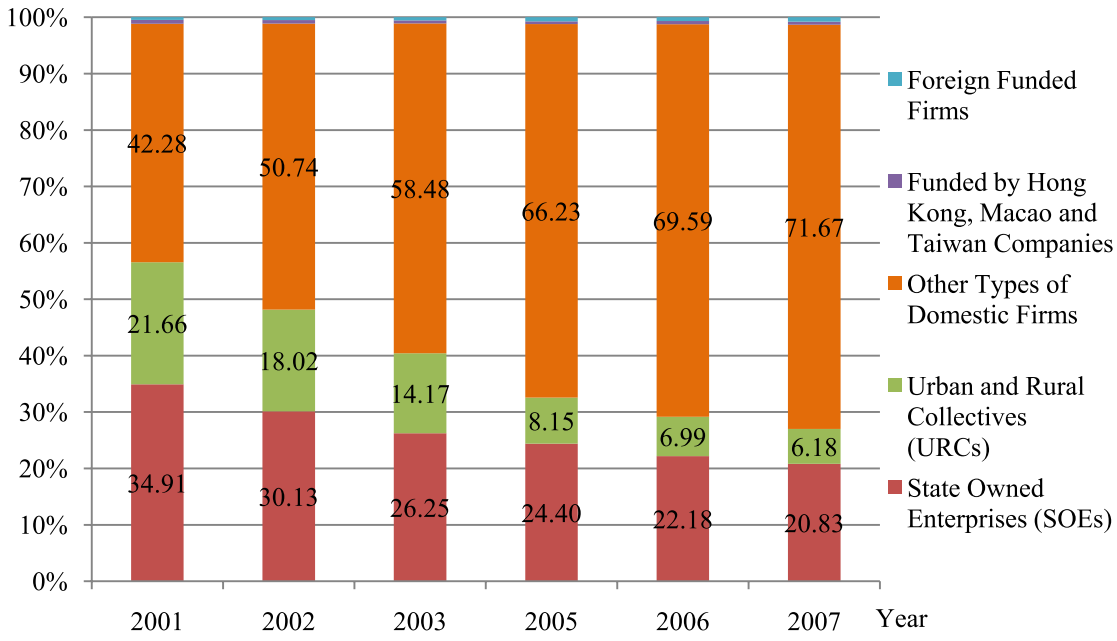


Figure 5.3.7 Market Structure (Gross Output Value) of
the Chinese Construction Industry Expressed in Percentage from 2001 to 2007

The Pearson correlation of Gross Output Value of all types of firms is presented in Table 5.3.9. The Pearson correlation of Gross Output Value of all firms and other types of domestic funded firms reaches 1.000 and is significant at the 0.01 level, again demonstrating that other types of domestic funded firms have become a very important part of the Chinese construction industry and will largely determine the development of the industry in the future. The Pearson correlation of Gross

Output Value of all firms and SOEs is the second strongest at 0.995 and is significant at the 0.01 level, indicating that although the number and market share of SOEs continued to decrease in recent years, the contribution of SOEs to the construction industry was still important. On the other hand, during this period URCs had lost their traditional importance and contributed less to the construction industry, with the Pearson correlation of -0.621, which is not significant. The development of foreign funded firms and firms funded by Hong Kong, Macao, and Taiwan companies also had close correlations with that of all firms, with the Pearson correlation of 0.994 and 0.986, respectively and the correlations are significant at the 0.01 level. This shows that after China's entry to the WTO, foreign funded construction firms had fewer barriers than before to succeed in the Chinese construction market.

Table 5.3.9 Pearson Correlation of Gross Output Value of All Types of Firms from 2001 to 2007

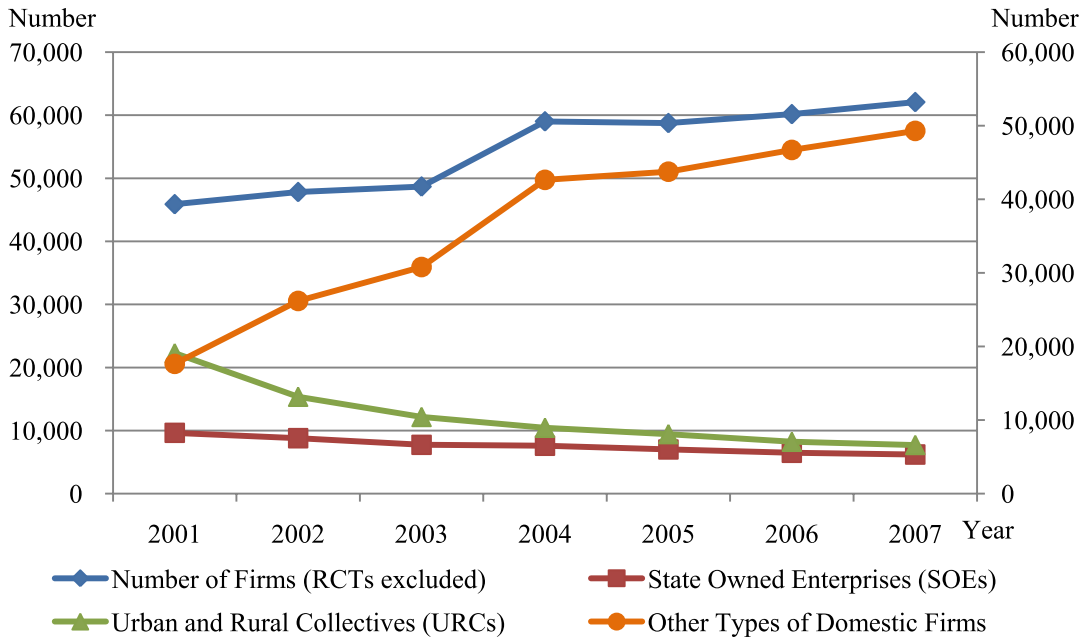
		SOEs	URCs	Other Types of Domestic Firms	Firms Funded by Hong Kong, Macao, and Taiwan Companies	Foreign Funded Firms
Gross Output Value of Firms	Pearson Correlation	.995*	-.621	1.000*	.986*	.994*
	Sig. (2-tailed)	.000	.188	.000	.000	.000
	N	6	6	6	6	6

*. Correlation is significant at the 0.01 level (2-tailed).

5.3.3.3 Growth of Domestic Funded Firms

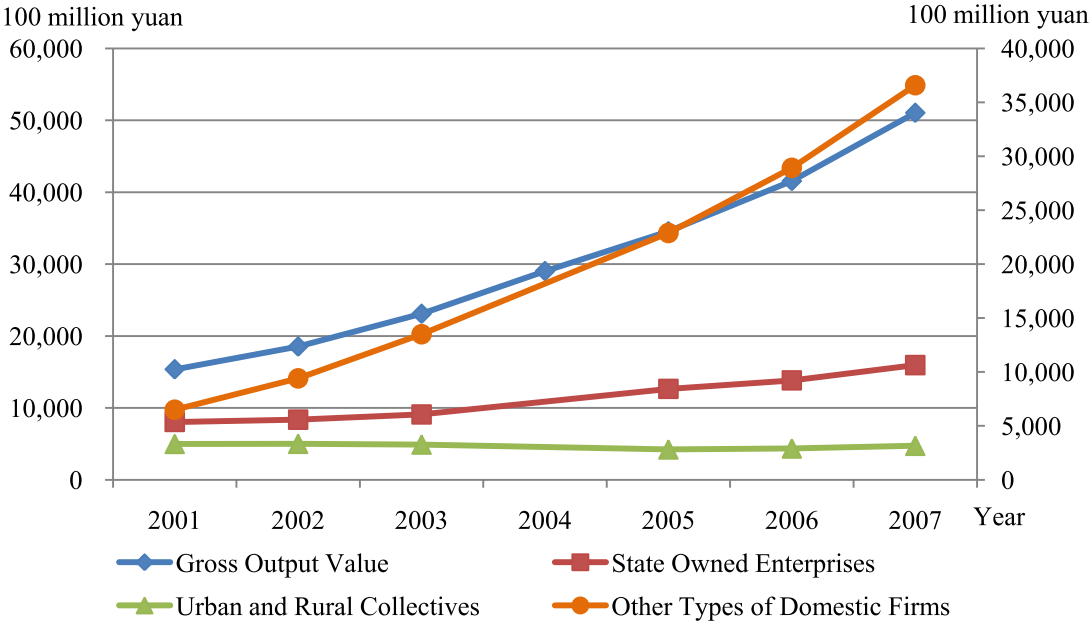
Figure 5.3.8 illustrates the growth of domestic funded firms from 2001 to 2007. The number of all firms increased slightly each year except 2004, when the total number climbed considerably by 21.22%. The number of other types of domestic funded firms had a similar developing tendency as the number of all firms with a sharp increase in 2004. On the other hand, the number of SOEs and URCs continuously declined each year, reaching the bottom in 2007. This growth tendency of domestic funded firms shows that after China's entry into the WTO, a large amount of construction firms, which were not fit for the free construction market, had been demolished or reformed into other forms, whereas other types of domestic firms with market oriented structure and management were more suitable for the new market.

Figure 5.3.9 depicts the growth of domestic funded construction firms in terms of Gross Output Value from 2001 to 2007. While the Gross Output Value of the construction industry increased steadily each year during this stage, that of other types of domestic funded firms surged considerably at an average growth rate almost twice that of all types of firms, being the main contributor to the Gross Output Value of the construction industry. The Gross Output Value of SOEs still increased gradually; that of URCs, on the other hand, decreased slightly and had the smallest share of that of all domestic funded construction firms.



Note: Number of Firms uses the left scale; others use the right scale.

Figure 5.3.8 Growth of Domestic Funded Firms Measured in Number of Firms from 2001 to 2007

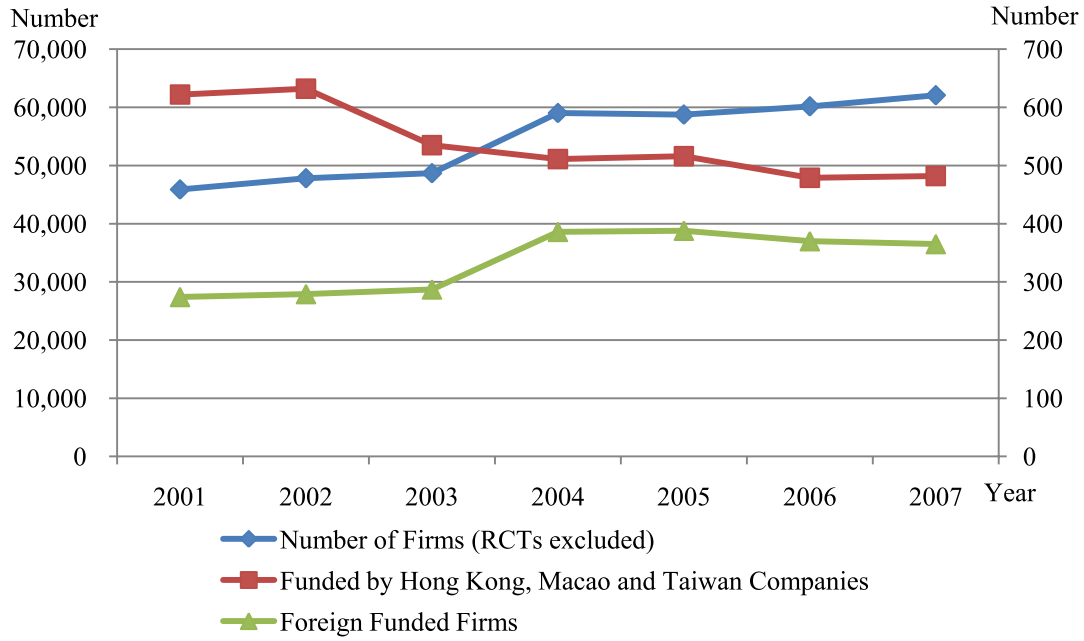


Note: Gross Output Value uses the left scale; others use the right scale.

Figure 5.3.9 Growth of Domestic Funded Firms Measured in Gross Output Value from 2001 to 2007

5.3.3.4 Growth of Foreign Funded Firms

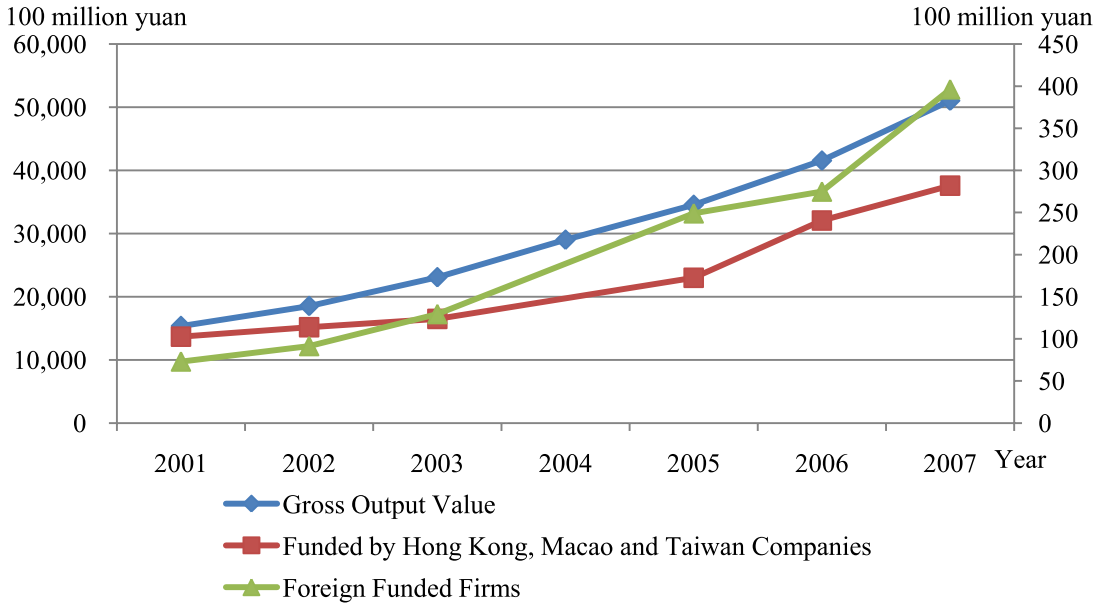
The growth of the construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies in terms of the number of firms from 2001 to 2007 is presented in Figure 5.3.10.The number of foreign funded firms had a similar trend as the number of all firms except that it dropped a little after 2005. However, the number of firms funded by Hong Kong, Macao, and Taiwan companies decreased during this period, especially in 2003, when the number declined by 15.35%. The reason for this might be that with the reform of domestic firms and the more liberalized construction market for foreign funded firms, they had become less competitive compared with other types of construction firms.



Note: Number of Firms uses the left scale; others use the right scale.

Figure 5.3.10 Growth of Foreign Funded Firms Measured in Number of Firms from 2001 to 2007

The growth of the construction firms funded by Hong Kong, Macao, Taiwan, and overseas companies in terms of Gross Output Value from 2001 to 2007 is depicted in Figure 5.3.11. The Gross Output Value of foreign funded firms had a higher growth rate than that of the construction firms funded by Hong Kong, Macao, and Taiwan companies, and had exceeded the latter since 2003. In the following years, the difference between the Gross Output Value of the construction firms funded by Hong Kong, Macao, Taiwan companies, and foreign funded firms became larger each year except 2006. It suggests that although the number of foreign funded firms was fewer than that of firms funded by Hong Kong, Macao, and Taiwan companies, the former had higher productivity and produced more output value during this period.



Note: Gross Output Value uses the left scale; others use the right scale.

Figure 5.3.11 Growth of Foreign Funded Firms Measured in Gross Output Value from 2001 to 2007

5.3.4 Summary

All the main economic indicators increased steadily without any decline, and the percentage of construction in GDP remained quite constant between 2001 and 2007, showing a rather stable development of the Chinese construction industry. The continuous increase of the profit rate demonstrates that the Chinese construction industry was successful in the process of reforming into a profit-oriented market. The construction market structure changed dramatically during this stage. The number of traditional SOEs and URCs continued to decline, while other types of domestic funded construction firms grew considerably and had become the most important part in the Chinese construction market. Foreign funded construction firms started to make progress after China's accession to the WTO, while construction firms funded by Hong Kong, Macao, and Taiwan companies were losing their competitiveness.

Chapter 6

Comparison of the Chinese and U.S. Construction Industries

In this chapter, the characteristics of the growth of the Chinese construction industry in the thirty years period (from 1978 to 2007) were analyzed in terms of Gross Domestic Product (GDP) and Gross Output Value, number of employees, and construction firm rankings. The characteristics of the growth of the U.S. construction industry in the same period were also analyzed and a comparison was conducted between the two construction industries in terms of economic indicators, and the number of firms and employees. The currency units used in this chapter are (1) U.S. dollar at the official exchange rate (the exchange rate determined by national authorities or the rate determined in the legally sanctioned exchange market) of one U.S. dollar equaling to 6.85 yuan, and (2) the purchasing power parity conversion factor. Based on these statistics, projections were made to answer the following question: When will the Chinese construction industry surpass the U.S. construction industry?

Data on the Chinese construction industry were obtained from the China Statistic Yearbooks 1996 and 2008; data on the U.S. construction industry were obtained from the Bureau of Economic Analysis, U.S. Department of Commerce.

The construction firm rankings were collected from Engineering News Record (ENR) yearly reports of The Top 225 International Contractors and The Top 225 Global Contractors from 2001 to 2008.

6.1 Characteristics of the Chinese Construction Industry

6.1.1 GDP and Gross Output Value

Table 6.1.1 presents the main economic indicators of the Chinese construction industry from 1978 to 2007. The average growth rate of value added of construction was slightly higher than that of GDP at close to 10%. At the same time, Gross Output Value of construction had an average growth rate of more than twice that of GDP and value added of construction, indicating that the Chinese construction industry was developing fast during the last 30 years.

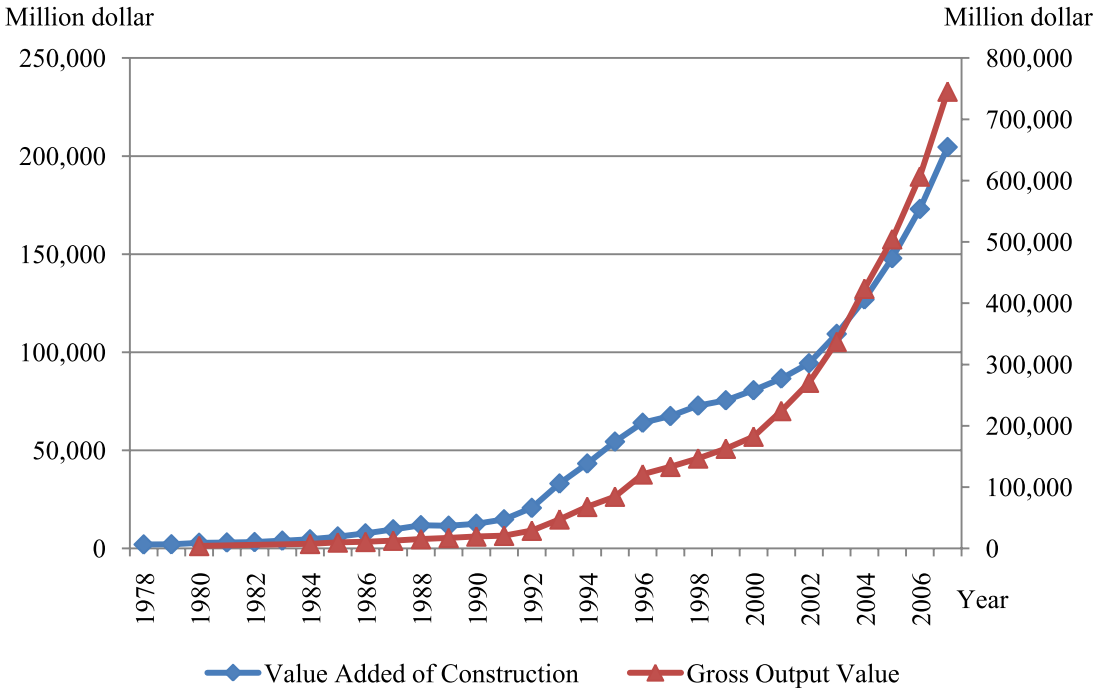
Although the average growth rate of Gross Output Value was much higher than that of value added of construction from 1978 to 2007, their growth tendencies were very similar, as depicted in Figure 6.1.1. Before 1992 during the first stage of reform, both indicators had relatively low values, because the base numbers of the two indicators in 1978 were small. During the second stage of reform, the value of both indicators increased considerably. This period can be divided into two parts. From 1992 to 1996, both indicators climbed greatly, with the highest average growth rates in all periods at 14.72% and 42.72%, respectively. From 1997 to 2001,

Table 6.1.1 GDP and Gross Output Value of the Chinese Construction Industry from 1978 to 2007

Year	GDP (Millions of dollars)	Value Added of Construction (Millions of dollars)	Percentage of Construction in GDP (%)	Construction Gross Output (Millions of dollars)
1978	53,215	2,018	3.79	-
1979	59,308	2,099	3.54	-
1980	66,359	2,854	4.30	4,189
1981	71,410	3,023	4.23	-
1982	77,713	3,222	4.15	-
1983	87,046	3,950	4.54	-
1984	105,227	4,623	4.39	7,550
1985	131,621	6,101	4.64	9,855
1986	150,003	7,674	5.12	10,796
1987	176,038	9,720	5.52	12,786
1988	219,603	11,825	5.38	15,232
1989	248,063	11,591	4.67	17,211
1990	272,523	12,546	4.60	19,635
1991	317,978	14,819	4.66	20,810
1992	393,043	20,657	5.26	29,050
1993	515,824	33,087	6.41	47,497
1994	703,618	43,280	6.15	67,932
1995	887,500	54,436	6.13	84,580
1996	1,039,074	64,049	6.16	120,909
1997	1,152,891	67,469	5.85	133,233
1998	1,232,150	72,785	5.91	146,890
1999	1,309,154	75,505	5.77	162,815
2000	1,448,388	80,617	5.57	182,447
2001	1,600,805	86,594	5.41	224,256
2002	1,756,682	94,386	5.37	270,470
2003	1,982,814	109,355	5.52	336,991
2004	2,333,990	126,924	5.44	423,671
2005	2,674,707	147,939	5.51	504,410
2006	3,093,774	173,009	5.62	606,674
2007	3,642,772	204,585	5.60	745,164
Average Growth Rate (%)	9.88	9.96	-	22.77

Note: Adapted from the China Statistic Yearbook 2008

however, the average growth rates of the two indicators dropped appreciably to only 5.67% and 13.25%, respectively. This might be due to the emergence of some serious problems in construction firms caused by the reform. Since 2002, the Chinese construction industry entered another booming period, when both indicators rose dramatically at relatively high growth rates.



Note: Value Added of Construction uses the left scale; Gross Output Value uses the right scale.

Figure 6.1.1 Value Added and Gross Output Value
of the Chinese Construction Industry from 1978 to 2007

Figure 6.1.2 illustrates the growth of the percentage of construction in GDP from 1978 to 2007. It fluctuated upwards gradually from 1978 to 1993, reaching the peak at 6.41% in 1993, and declined slightly then stabilized after 2001. The growth

trend of the percentage of construction in GDP demonstrates that the Chinese construction industry was developing from an unstable stage of reform to a stable stage of growth.

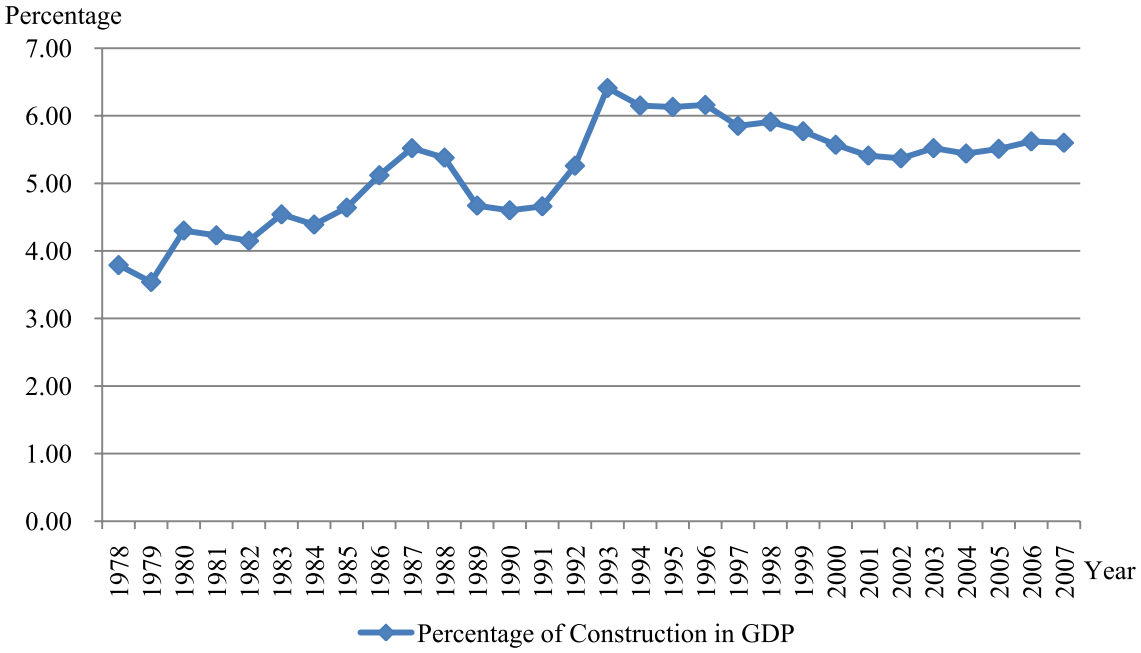


Figure 6.1.2 Percentage of Construction in China's GDP from 1978 to 2007

6.1.2 Number of Employees

The number of employees from 1978 to 2007 is displayed in Table 6.1.2 and Figure 6.1.3. It increased steadily in all the years except from 1993 to 2000, during which it rocketed from 1993 to 1996 and dropped slightly until 2000, similar to the tendency of value added and Gross Output Value of construction during this period, which had high growth rates in the first five years and low growth rates in the next five years. This demonstrates the problems faced by the construction firms during the second

Table 6.1.2 Number of Employees of the Chinese Construction Industry from 1978 to 2007 (Thousands)

Year	Number of Employees	Year	Number of Employees
1978	-	1994	14,459
1979	-	1995	14,979
1980	6,480	1996	21,219
1981		1997	21,015
1982	-	1998	20,300
1983	-	1999	20,201
1984	8,477	2000	19,943
1985	9,115	2001	21,107
1986	9,136	2002	22,452
1987	9,453	2003	24,143
1988	9,682	2004	25,003
1989	9,282	2005	26,999
1990	10,107	2006	28,782
1991	10,583	2007	31,337
1992	10,657	Average Growth Rate (%)	6.24
1993	11,381		

Note: Adapted from the China Statistic Yearbook 2008

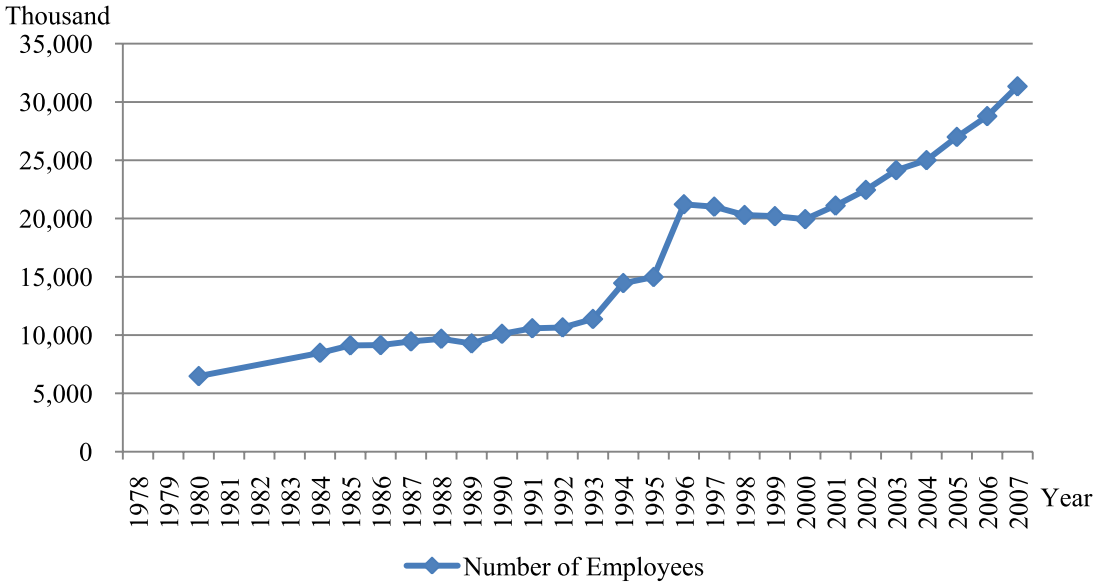


Figure 6.1.3 Number of Employees of the Chinese Construction Industry from 1978 to 2007

stage of reform. The average growth rate of the number of employees was 6.24%, far below those of the economic indicators, demonstrating that each individual employee was creating more output value.

6.1.3 Construction Firm Rankings

The number of Chinese construction firms ranked in The Top 225 Global and International Contractors from 2000 to 2007 both increased, as shown Table 6.1.3, Figure 6.1.4, and Figure 6.1.5. The Top 225 Global Contractors are ranked by their construction contracting revenue both at home and abroad; the Top 225 International Contractors are ranked according to construction revenue generated outside of each company's home country. In the Top 225 Global Contractors, China had four contractors ranked in the top ten in 2007, where no Chinese contractor was ranked before 2005. During the eight years the number of Chinese contractors ranked between 11 and 50 and between 51 and 100 were quite similar and grew only a little. The number of Chinese contractors ranked in the top ten and between 101 and 225 contributed to the main increase of the total number of Chinese contractors listed. In The Top 225 International Contractors, the total number of Chinese contractors listed was almost twice that in the Top 225 Global Contractors; however, the number ranked in the top ten remained zero each year and the number of Chinese contractors ranked between 11 and 50 was rather small. The main contributor to the

Top 225 International Contractors rankings was the Chinese contractors ranked between 101 and 225. This indicates that China had some very large contractors working mainly in domestic market, and although many Chinese contractors had projects overseas, the work and revenue was not significant to the overall output value.

Table 6.1.3 Number of Chinese Construction Firms Ranked in the Top 225

	The Top 225 Global Contractors					The Top 225 International Contractors				
Year	1-10	11-50	51-100	101-225	1-225	1-10	11-50	51-100	101-225	1-225
2000	0	4	5	8	17	0	2	7	25	34
2001	0	5	6	8	19	0	4	9	27	40
2002	0	5	5	8	18	0	3	12	28	43
2003	0	5	6	8	19	0	5	8	34	47
2004	0	8	5	9	22	0	4	5	40	49
2005	2	5	5	11	23	0	3	9	34	46
2006	4	3	4	14	25	0	2	12	35	49
2007	4	4	6	13	27	0	4	9	38	51

Note: Adapted from ENR The Top 225 Global Contractors and The Top 225 International Contractors 2000 through 2007

6.1.4 Summary

Value added and Gross Output Value of the Chinese construction industry had similar growth trends from 1978 to 2007. Both indicators had very low values from 1978 to 1992. Then, they increased considerably with the highest average growth rates in the thirty years until 1996, and slowed down in the next five years. Since 2002, both indicators again rose dramatically at high growth rates. The percentage of

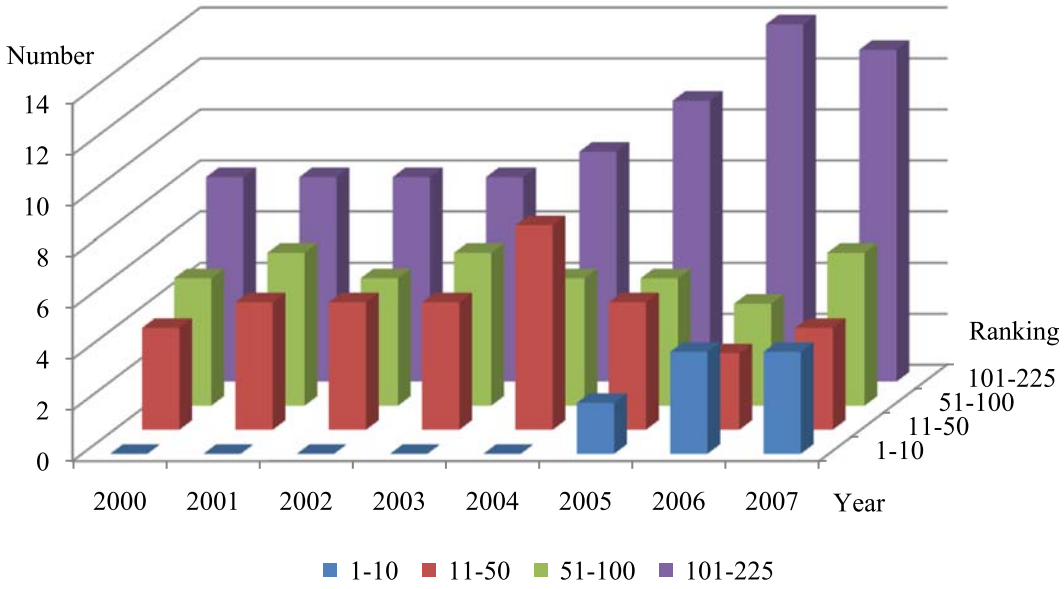


Figure 6.1.4 Number of Chinese Construction Firms Ranked in the Top 225 Global Contractors

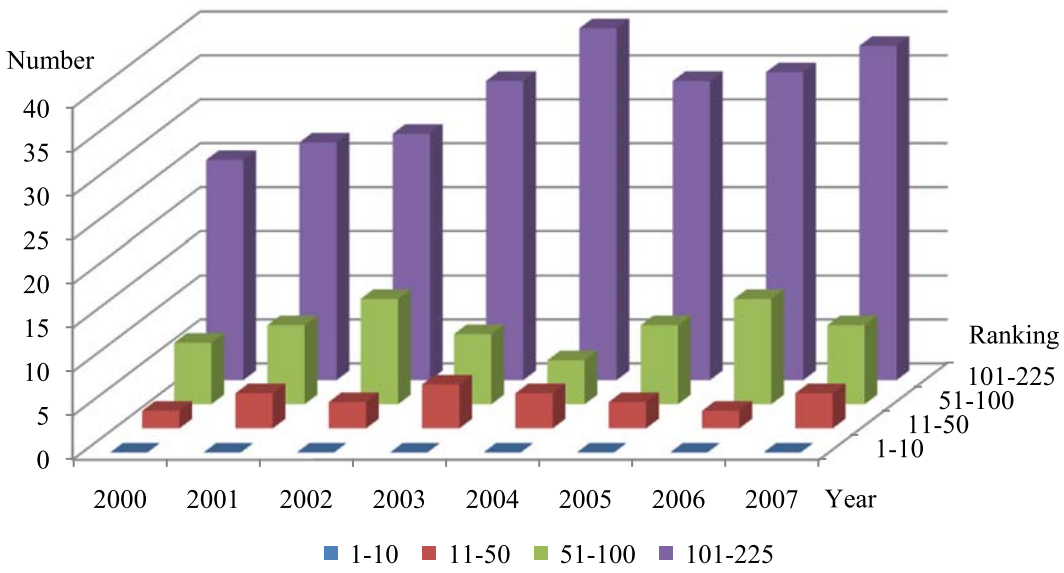


Figure 6.1.5 Number of Chinese Construction Firms Ranked in the Top 225 International Contractors

construction in GDP fluctuated upwards gradually from 1978 to 1993, declined slightly until 2001, then stabilized at about 5.50%, demonstrating that the Chinese construction industry was developing towards a more stable stage. The number of employees dropped from 1996 to 2000, indicating some problems faced by the construction firms during the second stage of reform, such as client forcing the price down, financing project during construction, arrears in project payments, bribery, and local or departmental protectionism. The major increase of the total number of Chinese contractors in Top 225 Global Contractors from 2000 to 2007 was from those ranked in the top ten and between 101 and 225. The main contributor to the Top 225 International Contractors ranking was the Chinese contractors ranked between 101 and 225. The growth tendencies of the two rankings suggest that China had some very large contractors working mainly in domestic market, and although many Chinese contractors had projects in overseas, the work and revenue were not significant to the overall output value.

6.2 Characteristics of the U.S. Construction Industry

6.2.1 GDP and Gross Output Value

Table 6.2.1 presents the main economic indicators of the U.S. construction industry from 1978 to 2007. The average growth rate of value added of construction was

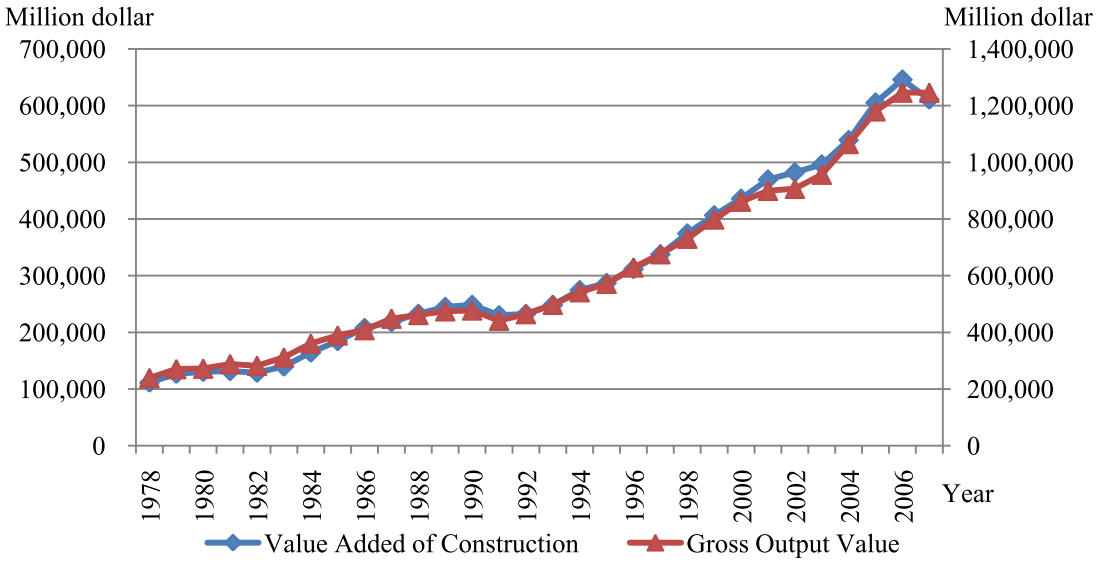
Table 6.2.1 GDP and Gross Output Value of the U.S. Construction Industry from 1978 to 2007

Year	GDP (Millions of dollars)	Value Added of Construction (Millions of dollars)	Percentage of Construction in GDP (%)	Construction Gross Output (Millions of dollars)
1978	2,294,705	111,475	4.86	239,311
1979	2,563,327	126,992	4.95	270,705
1980	2,789,504	130,330	4.67	272,446
1981	3,128,436	131,802	4.21	288,532
1982	3,255,009	128,811	3.96	282,272
1983	3,536,667	139,777	3.95	311,917
1984	3,933,168	164,450	4.18	360,817
1985	4,220,262	184,636	4.37	389,555
1986	4,462,824	207,664	4.65	408,246
1987	4,739,471	218,235	4.60	448,731
1988	5,103,790	232,728	4.56	461,650
1989	5,484,351	244,824	4.46	474,626
1990	5,803,067	248,465	4.28	477,648
1991	5,995,927	230,152	3.84	441,439
1992	6,337,744	232,471	3.67	464,659
1993	6,657,407	248,305	3.73	497,737
1994	7,072,225	274,432	3.88	541,979
1995	7,397,650	286,973	3.88	571,727
1996	7,816,862	311,684	3.99	629,410
1997	8,304,342	337,558	4.06	676,027
1998	8,746,997	374,387	4.28	730,787
1999	9,268,410	406,602	4.39	798,611
2000	9,816,969	435,914	4.44	861,470
2001	10,127,976	469,535	4.64	899,778
2002	10,469,601	482,277	4.61	906,899
2003	10,960,770	496,212	4.53	956,756
2004	11,685,901	539,216	4.61	1,064,927
2005	12,421,885	605,450	4.87	1,180,146
2006	13,178,376	646,015	4.90	1,246,340
2007	13,807,539	610,842	4.42	1,245,874
Average Growth Rate (%)	3.02	1.38	-	5.97

Note: Adapted from the Bureau of Economic Analysis, U.S. Department of Commerce

1.38%, lower than the growth rate of GDP at 3.02%. The average growth rate of Gross Output Value of construction was 5.97%, about four times that of value added of the U.S. construction industry.

Value added and Gross Output Value of the U.S. construction industry had almost the same growth tendency each year from 1978 to 2006, as depicted in Figure 6.2.1. In the 30 year period, the U.S. construction industry experienced four small regressions, which were in 1982, 1991, 2002, and 2007. In these four years both indicators either remained stable or grew negatively. Despite these minor setbacks, the U.S. construction industry grew steadily and reached the summit in 2006, according to both indicators.



Note: Value Added of Construction uses the left scale; Gross Output Value uses the right scale.

Figure 6.2.1 Value Added and Gross Output Value
of the U.S. Construction Industry from 1978 to 2007

Figure 6.2.2 illustrates the growth of the percentage of construction in GDP from 1978 to 2007. It fluctuated mainly within the range of 4% to 5%, with four low points in the years when the economic indicators dropped. This represents that the percentage of construction in GDP stayed closely to the economic status of the U.S. during the thirty years.

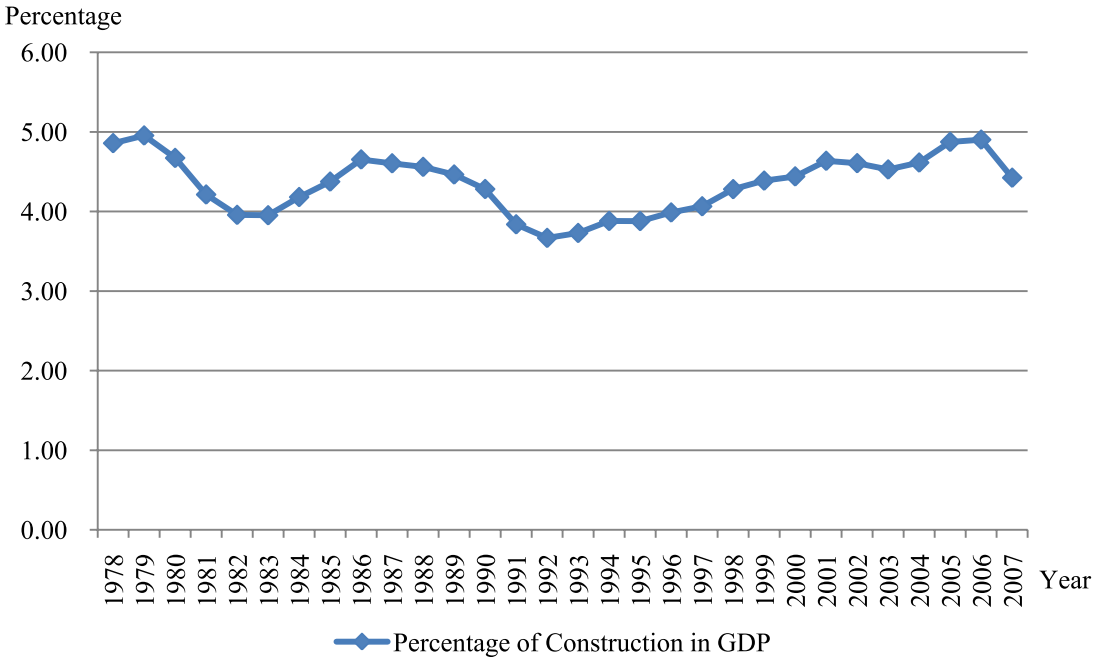


Figure 6.2.2 Percentage of Construction in U.S.'s GDP from 1978 to 2007

6.2.2 Number of Employees

Like the growth of economic indicators, that of the number of full-time and part-time employees also had four setbacks in 1982, 1991, 2002, and 2007, as displayed in Table 6.2.2 and Figure 6.2.3. The average growth rate of the number of

Table 6.2.2 Number of Employees of the U.S. Construction Industry from 1978 to 2007 (Thousands)

Year	Number of Employees	Year	Number of Employees
1978	4,478	1994	5,210
1979	4,747	1995	5,436
1980	4,530	1996	5,714
1981	4,374	1997	5,975
1982	4,061	1998	6,301
1983	4,111	1999	6,729
1984	4,592	2000	6,991
1985	4,936	2001	7,071
1986	5,114	2002	6,978
1987	5,222	2003	6,996
1988	5,362	2004	7,241
1989	5,432	2005	7,579
1990	5,395	2006	7,900
1991	4,929	2007	7,851
1992	4,775	Average Growth Rate (%)	2.05
1993	4,902		

Note: Adapted from the Bureau of Economic Analysis, U.S. Department of Commerce

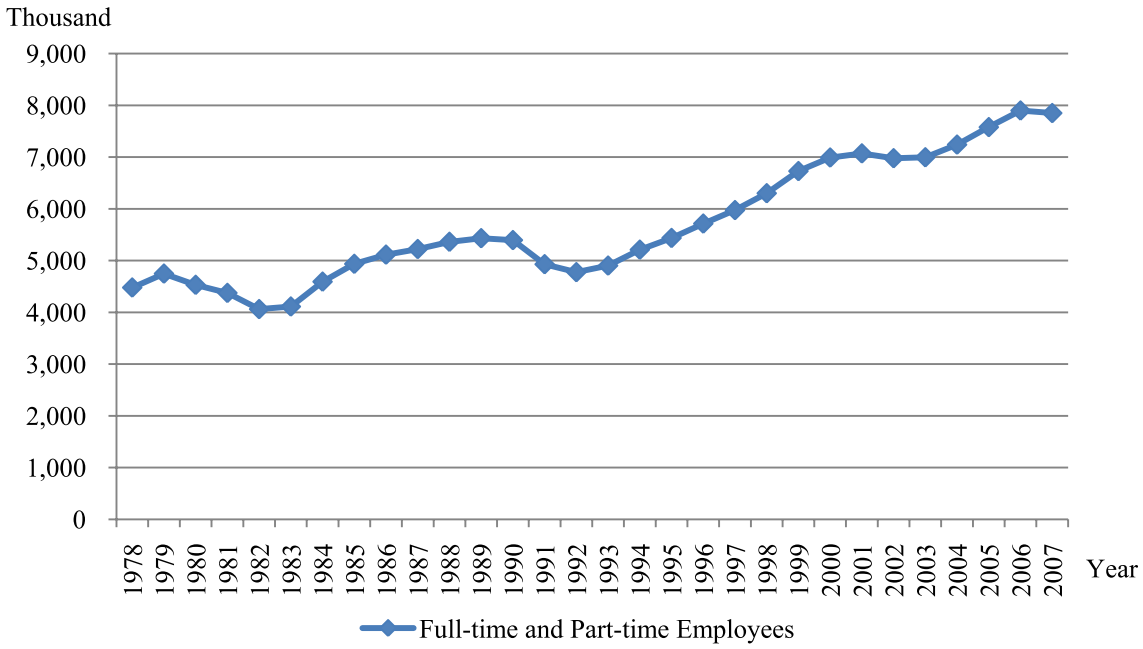


Figure 6.2.3 Number of Full-time and Part-time Employees of the U.S. Construction Industry from 1978 to 2007

employees was close to those of the economic indicators. It reflects that the growth of the number of employees was highly related to the development of the U.S. construction industry.

6.2.3 Construction Firm Rankings

Table 6.2.3, Figure 6.2.4, and Figure 6.2.5 show the number of U.S. construction firms ranked in The Top 225 Global and Top 225 International Contractors from 2000 to 2007. Both numbers ranked in the two lists reached the peak in 2001 and continuously declined to the bottom in 2007. The number of U.S. contractors ranked in each classification of the global and international rankings all decreased in the eight years. The number of U.S. contractors ranked in the top ten and between 11 and 50 declined slightly while the number of those ranked between 51 and 100 and between 101 and 225 dropped considerably.

Table 6.2.3 Number of U.S. Construction Firms Ranked in the Top 225

	The Top 225 Global Contractors					The Top 225 International Contractors				
Year	1-10	11-50	51-100	101-225	1-225	1-10	11-50	51-100	101-225	1-225
2000	2	8	29	83	122	3	7	9	54	73
2001	1	12	28	95	136	2	8	14	57	81
2002	1	8	28	88	125	1	8	8	58	75
2003	1	9	29	88	127	2	6	10	46	64
2004	1	5	24	81	111	2	6	8	38	54
2005	1	8	22	76	107	3	4	8	37	52
2006	1	6	25	71	103	3	5	4	39	51
2007	0	7	18	67	92	1	6	4	24	35

Note: Adapted from ENR The Top 225 Global Contractors and The Top 225 International Contractors 2000 through 2007

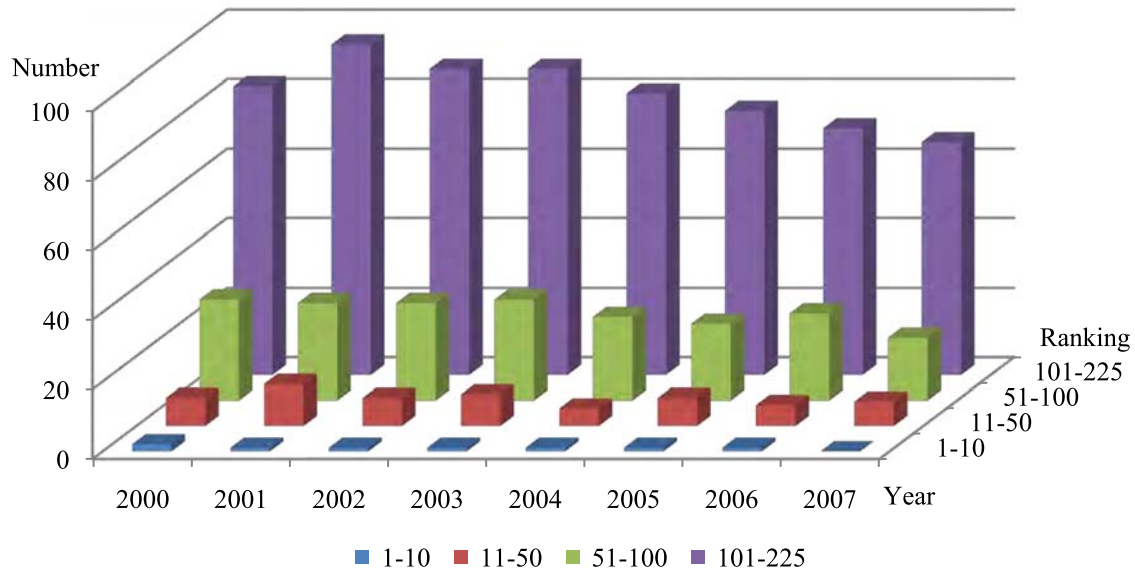


Figure 6.2.4 Number of U.S. Construction Firms
Ranked in the Top 225 Global Contractors

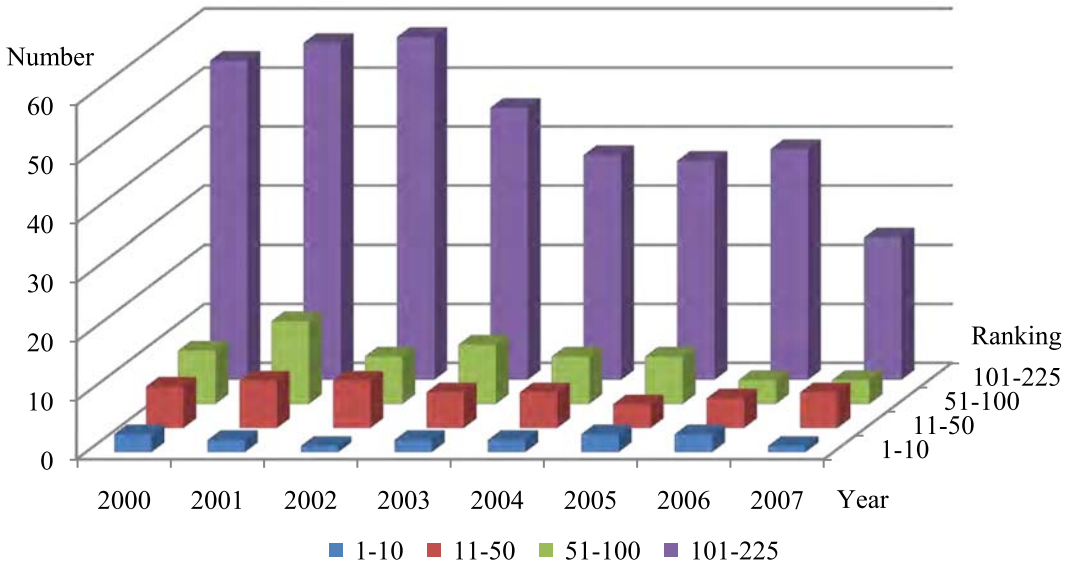


Figure 6.2.5 Number of U.S. Construction Firms
Ranked in the Top 225 International Contractors

6.2.4 Summary

Both economic indicators of the U.S. construction industry experienced four small regressions in the 30 year period, which were in 1982, 1991, 2002, and 2007. The percentage of construction in GDP fluctuated mainly within the range of 4% to 5%, with four low points in the years when the economic indicators dropped. The number of employees also had the same fluctuation as the economic indicators with the average growth rate of about 2%, reflecting a strong relationship with the development of the U.S. construction industry. The number of U.S. contractors ranked in each classification of the global and international rankings all decreased from 2000 to 2007. The number of U.S. contractors ranked between 51 and 100 and between 101 and 225 dropped considerably.

6.3 Comparison of the Chinese and U.S. Construction Industries

6.3.1 Economic Indicators

When comparing the economic indicators of the Chinese and U.S. construction industries, the purchasing power parity (PPP) conversion factor was used instead of the official exchange rate. Purchasing power parity conversion factor is the number of units of a foreign country's currency required to buy the same amount of goods and services in its domestic market that a U.S. dollar would buy in the United States

(World Development Indicators 2009). Since official exchange rates reflect at best the relative prices of tradable goods, the volume of goods and services that a U.S. dollar buys in the United States does not correspond to what a U.S. dollar converted to Chinese yuan at the official exchange rate would buy in China. The purchasing power parity conversion factor is preferred because it reflects differences in price levels for both tradable and nontradable goods and services and, therefore, provides a more meaningful comparison of real output (World Development Indicators 2009). According to the World Development Indicators 2009, the purchasing power parity conversion factor from Chinese yuan to U.S. dollar is 3.6 in 2007. The following comparisons of economic indicators of the Chinese and U.S. construction industries are based on the purchasing power parity conversion factor.

Table 6.3.1, Figure 6.3.1 and Figure 6.3.2 show the comparison of value added and Gross Output Value of the Chinese and U.S. construction industries based on PPP from 1978 to 2007; Figure 6.3.3 and Figure 6.3.4 present the comparison of value added and Gross Output Value based on both official exchange rate and PPP in five year intervals. The two economic indicators of the Chinese construction industry started at very low points compared with those of the U.S. construction industry. However, they grew much faster than the latter with no obvious decline. In late 1970s, the two economic indicators of the Chinese construction industry were

Table 6.3.1 Comparison of Value Added and Gross Output Value of the Chinese and U.S. Construction Industries (Based on PPP)

Year	Value Added of Construction (Millions of dollars)		Construction Gross Output (Millions of dollars)	
	China	U.S.	China	U.S.
1978	3,839	111,475	-	239,311
1979	3,994	126,992	-	270,705
1980	5,431	130,330	7,970	272,446
1981	5,753	131,802	-	288,532
1982	6,131	128,811	-	282,272
1983	7,517	139,777	-	311,917
1984	8,797	164,450	14,365	360,817
1985	11,608	184,636	18,753	389,555
1986	14,603	207,664	20,543	408,246
1987	18,494	218,235	24,329	448,731
1988	22,500	232,728	28,983	461,650
1989	22,056	244,824	32,749	474,626
1990	23,872	248,465	37,361	477,648
1991	28,197	230,152	39,597	441,439
1992	39,306	232,471	55,275	464,659
1993	62,957	248,305	90,376	497,737
1994	82,352	274,432	129,259	541,979
1995	103,579	286,973	160,938	571,727
1996	121,871	311,684	230,063	629,410
1997	128,378	337,558	253,513	676,027
1998	138,493	374,387	279,500	730,787
1999	143,670	406,602	309,802	798,611
2000	153,397	435,914	347,156	861,470
2001	164,769	469,535	426,710	899,778
2002	179,596	482,277	514,644	906,899
2003	208,077	496,212	641,219	956,756
2004	241,508	539,216	806,151	1,064,927
2005	281,494	605,450	959,781	1,180,146
2006	329,197	646,015	1,154,366	1,246,340
2007	389,281	610,842	1,417,881	1,245,874
Average Growth Rate (%)	9.96	1.38	22.77	5.97

Note: Adapted from the China Statistic Yearbook 2008 and the Bureau of Economic Analysis, U.S. Department of Commerce

only around 3% of those of the U.S. construction industry. By 2007, value added of the Chinese construction industry had been more than 60% of that of the U.S. construction industry, and its Gross Output Value had even surpassed that of the latter.

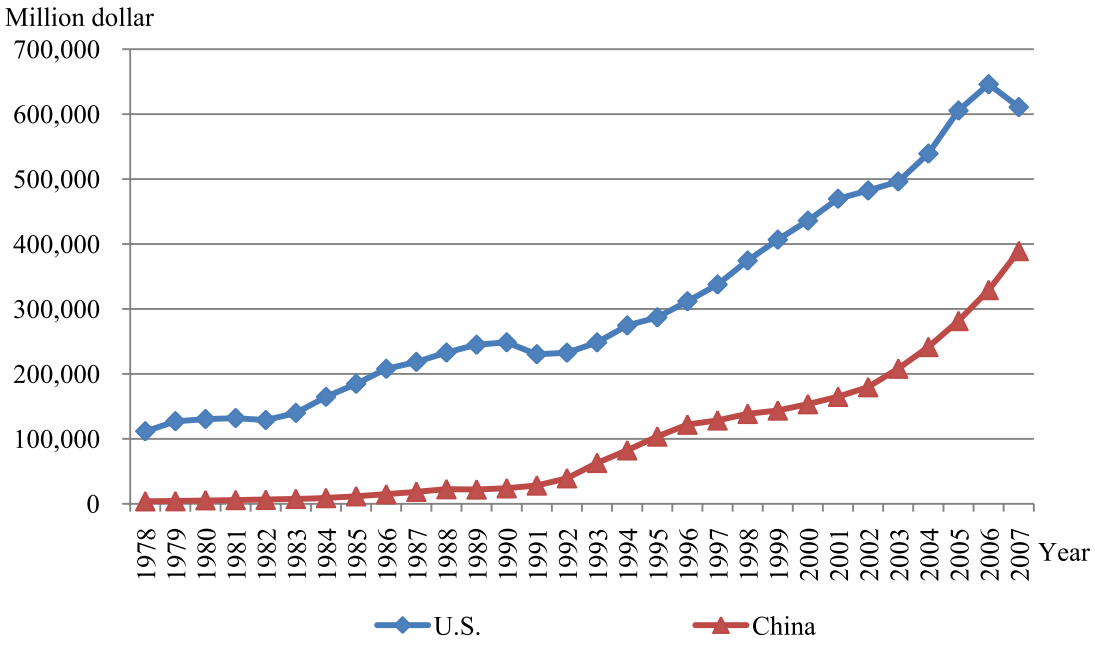


Figure 6.3.1 Comparison of Value Added of the Chinese and U.S. Construction Industries (Based on PPP)

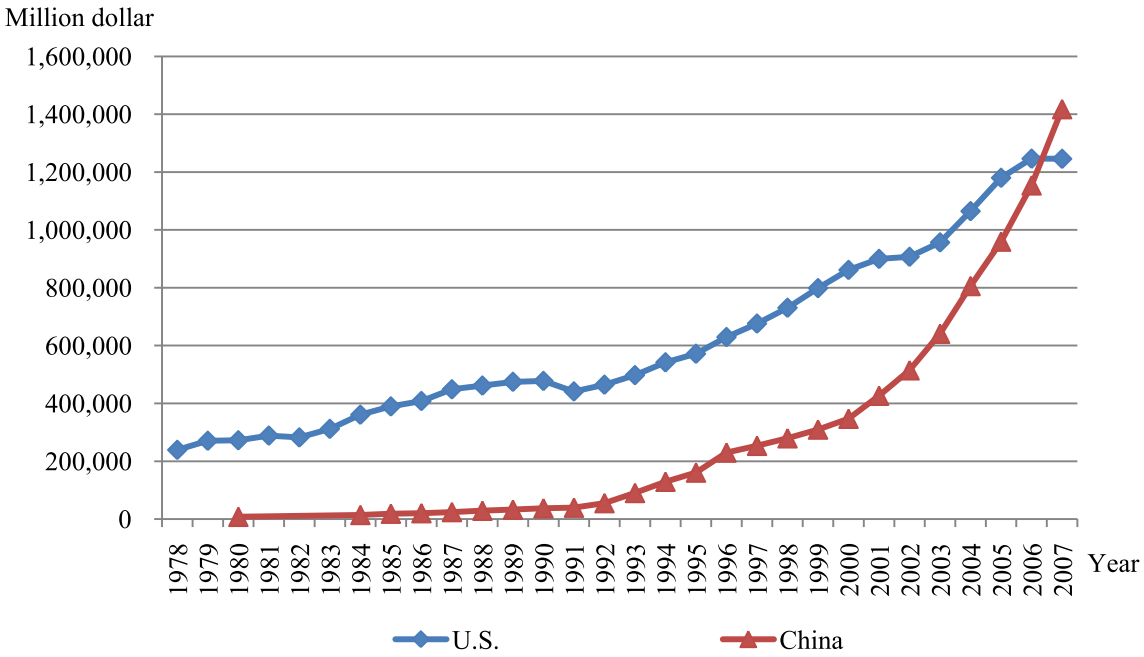


Figure 6.3.2 Comparison of Gross Output Value of the Chinese and U.S. Construction Industries (Based on PPP)

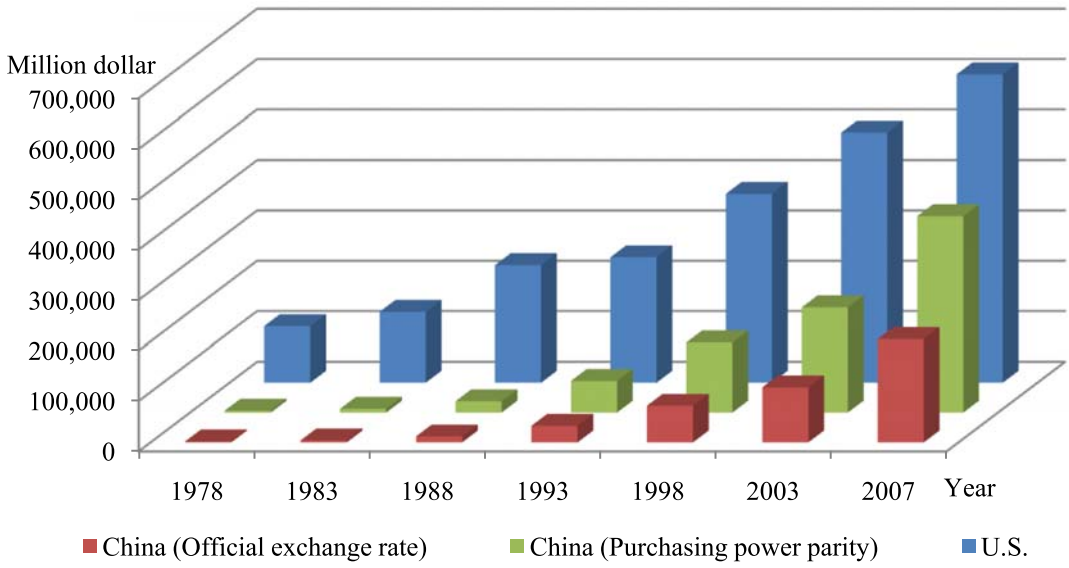


Figure 6.3.3 Comparison of Value Added of the Chinese and U.S. Construction Industries in Five Year Intervals (Millions of dollars)

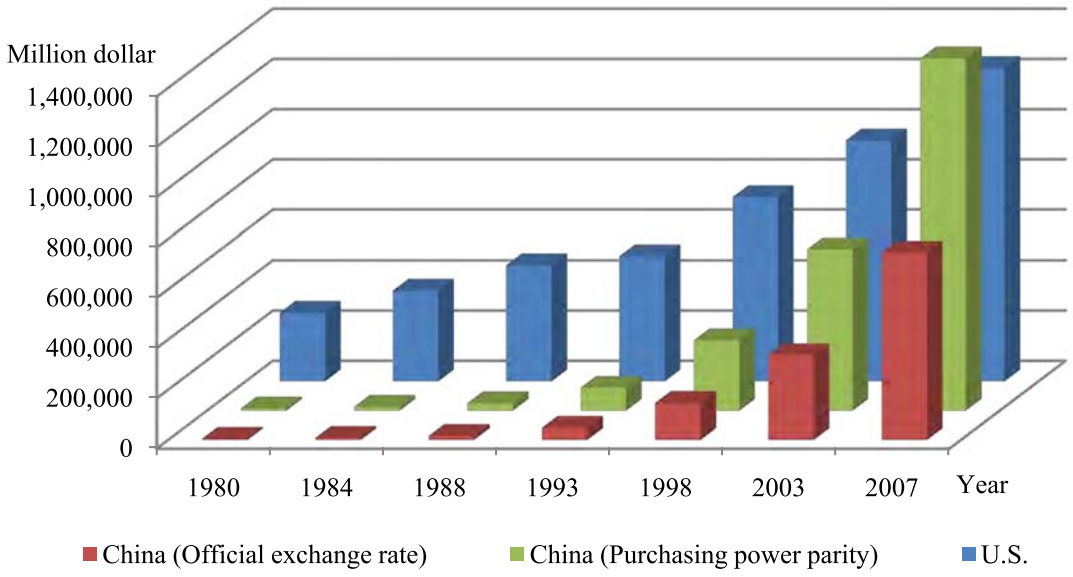


Figure 6.3.4 Comparison of Gross Output Value of the Chinese and U.S. Construction Industries in Five Year Intervals (Millions of dollars)

6.3.2 Employees and Firms

The number of employees of the Chinese construction industry was constantly more than that of the U.S. construction industry, and the difference grew bigger as the number of years passed, as presented in Table 6.3.2 and Figure 6.3.5. The number of employees of the U.S. construction industry fluctuated and increased slightly while that of the Chinese construction industry climbed dramatically between 1993 and 1996 and after 2000. It demonstrates that the Chinese construction industry was still a labor intensive industry compared with the U.S. construction industry, despite that the output value of individual employees actually increased considerably.

Table 6.3.3, Figure 6.3.6 and Figure 6.3.7 display the comparison of the

number of Chinese and U.S. construction firms ranked in The Top 225 Global and International Contractors. The United States had much more global contractors than China that were ranked in the top 225; however, the number of U.S. global contractors ranked in the top 225 has continuously declined since 2001, while that of the Chinese global contractors has increased slightly. For the international contractor rankings, the number of U.S. contractors had the same trend as that in the global contractor rankings, and was surpassed by the number of Chinese international contractors in 2007, which had a steady growth tendency.

Table 6.3.2 Comparison of Number of Employees of the Chinese and U.S. Construction Industries (Thousands)

Year	China	U.S.	Year	China	U.S.
1978	-	4,478	1994	14,459	5,210
1979	-	4,747	1995	14,979	5,436
1980	6,480	4,530	1996	21,219	5,714
1981	-	4,374	1997	21,015	5,975
1982	-	4,061	1998	20,300	6,301
1983	-	4,111	1999	20,201	6,729
1984	8,477	4,592	2000	19,943	6,991
1985	9,115	4,936	2001	21,107	7,071
1986	9,136	5,114	2002	22,452	6,978
1987	9,453	5,222	2003	24,143	6,996
1988	9,682	5,362	2004	25,003	7,241
1989	9,282	5,432	2005	26,999	7,579
1990	10,107	5,395	2006	28,782	7,900
1991	10,583	4,929	2007	31,337	7,851
1992	10,657	4,775	Average Growth Rate (%)	6.24	2.05
1993	11,381	4,902			

Note: Adapted from the China Statistic Yearbook 2008 and the Bureau of Economic Analysis, U.S. Department of Commerce

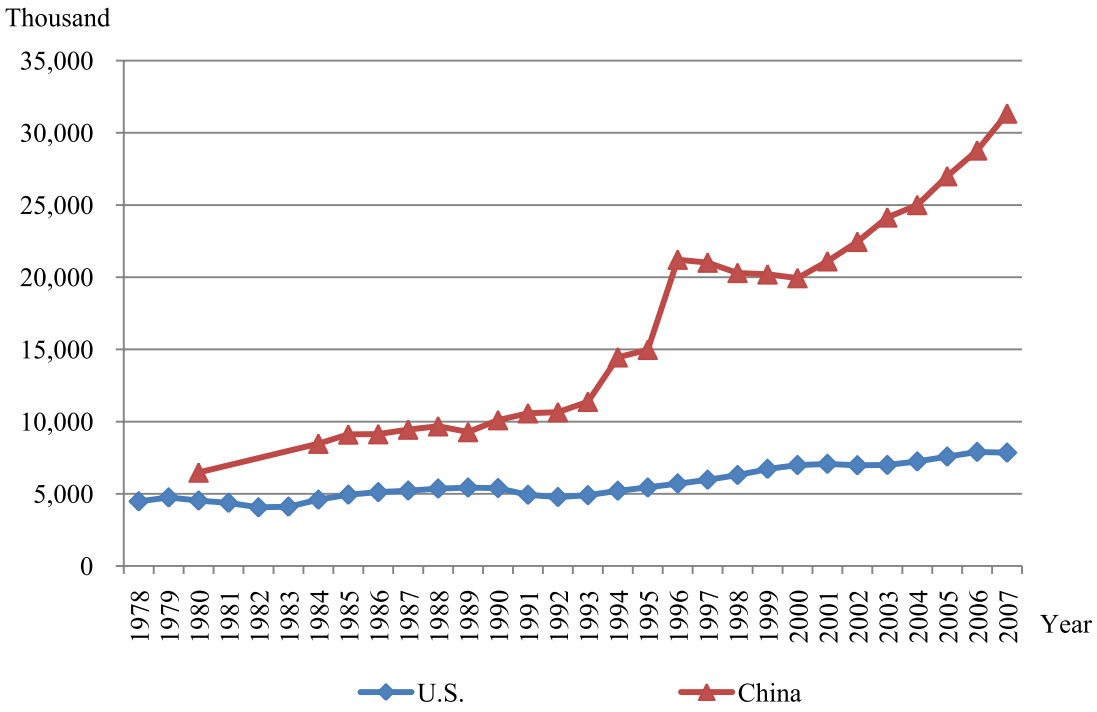


Figure 6.3.5 Comparison of Number of Employees of the Chinese and U.S. Construction Industries

Table 6.3.3 Comparison of Number of Chinese and U.S. Construction Firms Ranked in the Top 225

Year	The Top 225 Global Contractors		The Top 225 International Contractors	
	China	U.S.	China	U.S.
2000	17	122	34	73
2001	19	136	40	81
2002	18	125	43	75
2003	19	127	47	64
2004	22	111	49	54
2005	23	107	46	52
2006	25	103	49	51
2007	27	92	51	35

Note: Adapted from ENR The Top 225 Global Contractors and The Top 225 International Contractors 2000 through 2007

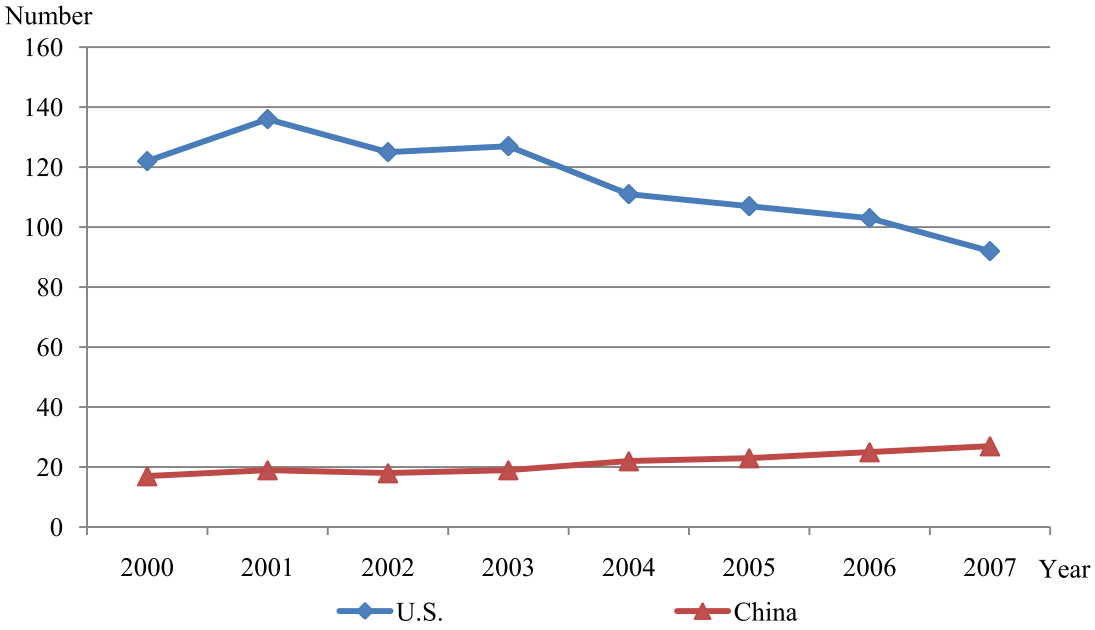


Figure 6.3.6 Comparison of Number of Chinese and U.S. Construction Firms Ranked in the Top 225 Global Contractors

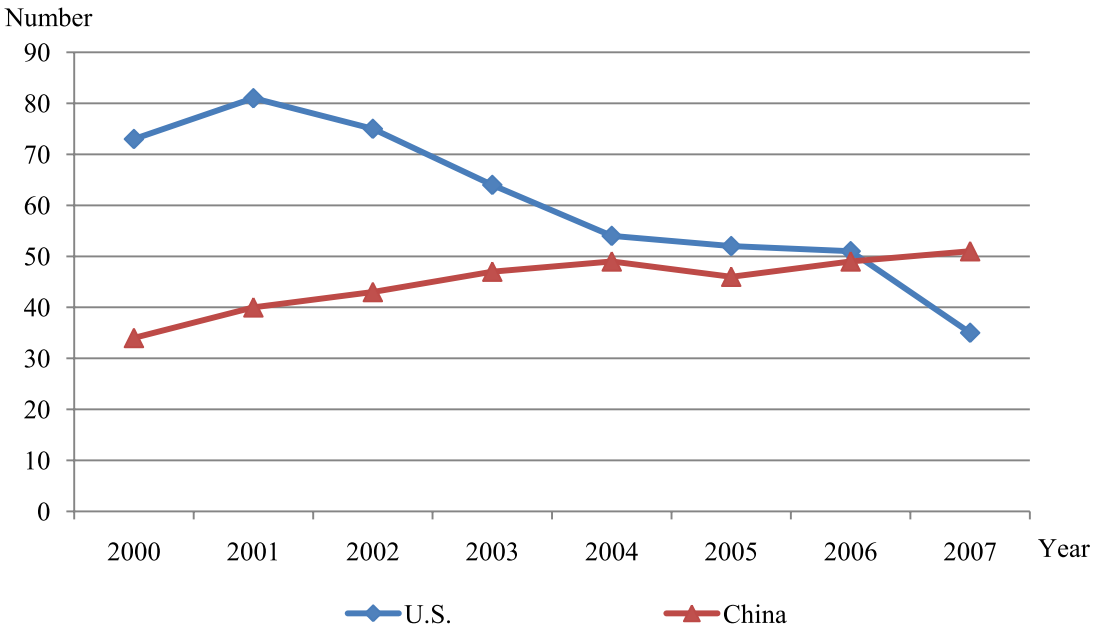


Figure 6.3.7 Comparison of Number of Chinese and U.S. Construction Firms Ranked in the Top 225 International Contractors

6.3.3 Summary

Based on PPP, the two economic indicators of the Chinese construction industry started at very low points; however, they grew much fast with no obvious decline. By 2007, value added of the Chinese construction industry had been more than 60% of that of the U.S. construction industry, and its Gross Output Value had even surpassed that of the latter. The number of employees of the Chinese construction industry was constantly more than that of the U.S. construction industry, and the difference grew bigger as the number of years passed, demonstrating that the Chinese construction industry was still a labor intensive industry compared with the U.S. construction industry. In terms of the number of contractors ranked in the top 225 lists, the United States had much more global contractors than China that were ranked in the top 225; however, their number has continuously declined since 2001. The number of U.S. contractors ranked in The Top 225 International Contractors has also decreased and surpassed by the number of Chinese international contractors in 2007.

6.4 Projection of the Chinese Construction Industry

Projections of the future development of the Chinese construction industry were based on the following assumptions: (1) the growth rates of the indicators will keep

similar to current values and no major economic recession will happen; (2) political policies will remain stable and no military conflicts will occur; (3) enough resources are available to support industry growth; and (4) exchange rates stay the same as those used in this chapter, which are the official exchange rate of one U.S. dollar equaling to 6.85 Chinese yuan, and the purchasing power parity at 3.6.

6.4.1 Projection Based on Official Exchange Rate

Projections of value added and Gross Output Value of the Chinese and U.S. construction industries were conducted using polynomial functions, which will largely match the growth of existing data.

Figure 6.4.1 displays the projection of value added of the Chinese and U.S. construction industries based on official exchange rate. The polynomial functions suggest that value added of the Chinese construction industry will overtake that of the U.S. construction industry at about 3.5 trillion dollars in 2054. The polynomial function of value added of the U.S. construction industry is

$$y = 562.15x^2 + 143.86x + 129208 \quad (6.1)$$

where

x = year

y = value added of the U.S. construction industry in million dollars

The polynomial function of value added of the Chinese construction industry based

on official exchange rate is

$$y = 8.713x^3 - 93.928x^2 + 1281.8x - 1372.7 \quad (6.2)$$

where

x = year

y = value added of the Chinese construction industry in million dollars

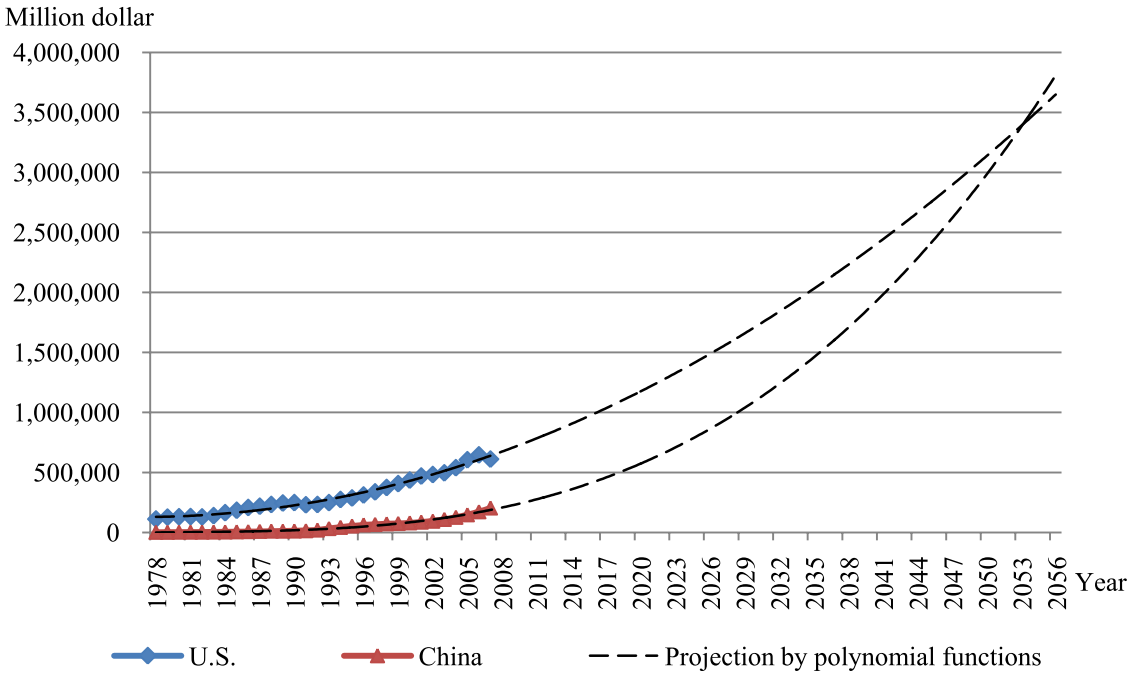


Figure 6.4.1 Projection of Value Added of the Chinese and U.S. Construction Industries Based on Official Exchange Rate

Figure 6.4.2 presents the projection of Gross Output Value of the Chinese and U.S. construction industries based on official exchange rate. According to the polynomial functions, the Gross Output Value of the Chinese construction industry will surpass that of the U.S. construction industry at about 1.8 trillion dollars at the

beginning of 2015.

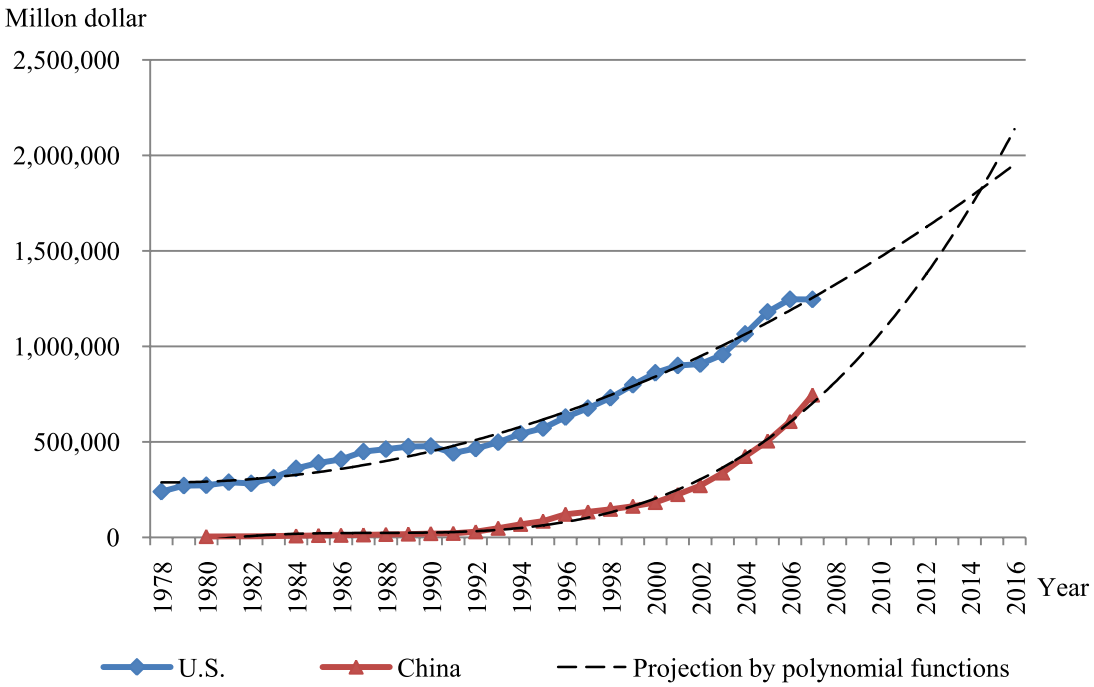


Figure 6.4.2 Projection of Gross Output Value of the Chinese and U.S. Construction Industries Based on Official Exchange Rate

The polynomial function of Gross Output Value of the U.S. construction industry is

$$y = 1165.4x^2 - 2804x + 289537 \qquad (6.3)$$

where

x = year

y = Gross Output Value of the U.S. construction industry in million dollars

The polynomial function of Gross Output Value of the Chinese construction industry based on official exchange rate is

$$y = 91.109x^3 - 2870.7x^2 + 30348x - 84644 \qquad (6.4)$$

where

x = year

y = Gross Output Value of the Chinese construction industry in million dollars

6.4.2 Projection Based on Purchasing Power Parity

Figure 6.4.3 displays the projection of value added of the Chinese and U.S. construction industries based on PPP. The polynomial functions show that value added of the Chinese construction industry will be equal to that of the U.S. construction industry at about 1.3 trillion dollars at the beginning of 2023. The polynomial function of value added of the U.S. construction industry is the same as Equation 6.1. The polynomial function of value added of the Chinese construction industry based on PPP is

$$y = 16.579x^3 - 178.73x^2 + 2439.2x - 2612.1 \quad (6.5)$$

where

x = year

y = value added of the Chinese construction industry in million dollars

The Gross Output Value of the Chinese construction industry based on PPP has surpassed that of the U.S. construction industry since 2007, as displayed in Figure 6.3.2.

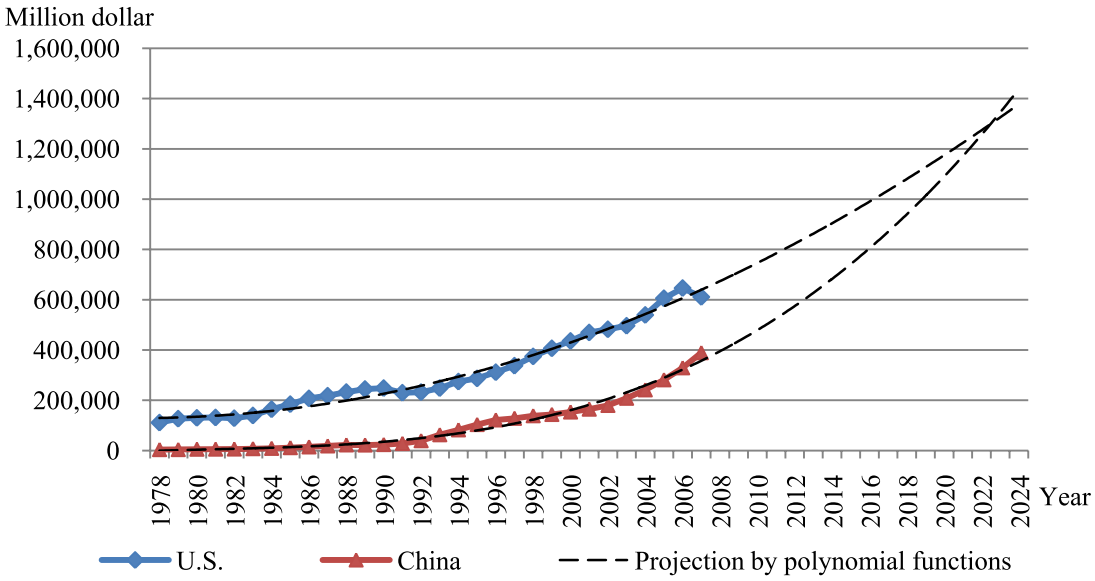


Figure 6.4.3 Projection of Value Added of the Chinese and U.S. Construction Industries Based on Purchasing Power Parity

6.4.3 Summary

Based on the official exchange rate, value added of the Chinese construction industry is projected to overtake that of the U.S. construction industry at about 3.5 trillion dollars in 2054, and Gross Output Value surpassing that of the latter at about 1.8 trillion dollars at the beginning of 2015, according to polynomial functions.

Based on PPP, projections by polynomial functions suggest that value added of the Chinese construction industry will be equal to that of the U.S. construction industry at about 1.3 trillion dollars at the beginning of 2023. The Gross Output Value of the Chinese construction industry has surpassed that of the latter since 2007.

Chapter 7

Conclusions and Recommendations

7.1 Conclusions

The Chinese construction industry had been developing and reforming during the three stages indentified in this research. The growth of main economic indicators, employees and equipment, and the change of market structure were different during each stage with their specific characteristics as concluded in Chapter 5. Comparisons of economic indicators, employees, and construction firms were conducted between the Chinese and U.S. construction industries in Chapter 6, and projections of the future development of the Chinese construction industry were made based on available data.

7.1.1 The Development of the Chinese Construction Industry during the First Stage of Reform

From 1978 to 1992, although the growth of value added and Gross Output Value of the Chinese construction industry was not slow, they were in a relatively low level because of low starting points. Most of the indicators, including value added of construction, number of employees, and number of firms, experienced a decline in 1989. The number of rural construction teams (RCTs) had declined considerably

since 1985, showing that the reform of the Chinese construction industry had brought initial change in terms of market structure under new rules and regulations during this stage.

7.1.2 The Development of the Chinese Construction Industry during the Second Stage of Reform

From 1992 to 2001, although the economic indicators of the Chinese construction industry remained high, their growth rates were not consistent during this period. Between 1992 and 1996, the economic indicators climbed greatly with the highest average growth rates in all periods, while between 1997 and 2001, on the other hand, their average growth rates dropped appreciably to almost half of the average level of all 30 years. Despite this inconsistency, the profit rate was rising, representing that the Chinese construction industry was reforming from a non-profit and planned industry into a profit-oriented industry. In addition, the market structure of the industry changed dramatically. The number of state owned enterprises (SOEs) and urban-rural collectives (URCs) both decreased after 1996. The number of other types of domestic funded construction firms grew greatly after 1995, and their contribution to GDP became the largest in all types of construction firms in 2001. On the other hand, foreign funded firms were struggling after 1997, reflecting that they were not yet able to adapt well to the business environment of the Chinese construction market during

this period.

7.1.3 The Development of the Chinese Construction Industry during the Third Stage of Reform

From 2001 to 2007, all the economic indicators increased steadily without any decline, and the percentage of construction in GDP remained quite stable, reflecting that the Chinese construction industry was developing at a consistent rate during this period. On the other hand, the construction market structure changed dramatically. The number of traditional SOEs and URCs declined while other types of domestic funded construction firms grew considerably and became the most important part in both number and contribution to GDP in the Chinese construction industry. The number of foreign funded construction firms also increased after China's accession to the WTO.

7.1.4 Comparison of the Chinese and U.S. Construction Industries

Comparison of the economic indicators of the Chinese and U.S. construction industries is based on purchasing power parity (PPP). Compared with those of the U.S. construction industry, value added and Gross Output Value of the Chinese construction industry started at very low points; however, they grew much faster than the former with no obvious decline. The economic indicators of the U.S. construction industry, on the other hand, experienced four apparent setbacks in 1982, 1991, 2002, and 2007. The economic indicators of the Chinese construction industry grew from

around only 3% of the U.S. construction industry in the late 1970s, to more than 60% of value added and more than 110% of Gross Output Value of the U.S. construction industry in 2007.

The number of employees of the Chinese construction industry was constantly more than that of the U.S. construction industry, and the difference grew bigger as the number of years passed. The number of employees of the U.S. construction industry fluctuated and increased slightly while that of the Chinese construction industry climbed dramatically between 1993 and 1996 and after 2000, demonstrating that although the output value of individual employees increased considerably, the Chinese construction industry was still a labor intensive industry compared with the U.S. construction industry.

The number of U.S. contractors ranked in The Top 225 Global Contractors was much more than that of Chinese contractors; however, the former has declined continuously since 2001, while the latter increased slightly. The number of U.S. contractors ranked in The Top 225 International Contractors has also decreased since 2001 and was surpassed by that of Chinese international contractors in 2007.

7.1.5 Projection of the Chinese Construction Industry

Based on official exchange rate, value added of the Chinese construction industry is projected to overtake that of the U.S. construction industry at about 3.5 trillion dollars

in 2054, and Gross Output Value surpassing that of the latter at about 1.8 trillion dollars at the beginning of 2015, according to polynomial functions.

Based on PPP, projections by polynomial functions suggest that value added of the Chinese construction industry will be equal to that of the U.S. construction industry at about 1.3 trillion dollars at the beginning of 2023. The Gross Output Value of the Chinese construction industry has surpassed that of the latter since 2007.

7.2 Recommendations

7.2.1 Recommendations for U.S. Architectural, Engineering and Construction Firms

After China's accession to the World Trade Organization (WTO), the Gross Output Value of foreign funded construction firms grew rapidly from 7 billion dollars in 2001 to nearly 40 billion dollars in 2007 at the average growth rate of around 30% (see Table 5.3.8 and Figure 5.3.11). At the same time, the profit rate of foreign funded construction firms in 2007 was 7.0% and that of foreign solely owned construction firms even reached 15.8%, much higher than the average profit rate of Chinese firms at the level of 3.1% (China Statistical Yearbook 2008). These figures suggest that after China's entry into WTO, foreign funded firms have succeeded and gained great profit in the Chinese construction market. Moreover, quality and safety issues are

becoming more important in recent years, which are the advantages that the U.S. architectural, engineering and construction (AEC) firms have. Therefore, it is the right time for U.S. AEC firms to enter the Chinese construction market, one with huge potential.

On the other hand, U.S. AEC firms must realize that they are more vulnerable and less likely to adapt to changes of laws and regulations than domestic funded construction firms in the short term. Between 1997 and 2001, the number of foreign funded construction firms decreased considerably and their Gross Output Value increased little. Before entering the Chinese construction market, U.S. AEC firms have to become familiar with government policies, laws and regulations, and local business environment.

7.2.2 Recommendations for Future Research

In this research, data are not sufficient enough to cover all aspects of the Chinese construction industry during the three stages. Data on Gross Output Value of construction, number of employees, and number of all types of firms are not available in 1978, 1979, and from 1981 to 1983; data on profit rate, number and Gross Output Value of construction firms funded from Hong Kong, Macao, Taiwan, and overseas, and other types of domestic funded firms are not available before 1995; data on pieces of equipment are not available before 1991. If future researchers can access

these data, the analysis of the Chinese construction industry during the three stages will be more comprehensive and convincing. At the same time, data analysis was conducted in general and limited areas, such as economic indicators and employees and firms. Therefore, analysis on more specified fields is recommended for future research, such as productivity, quality and safety issues, and project management methods.

This research project presents the analysis of the growth trend of the Chinese construction industry from 1978 to 2007, without considering the problems that it was facing and the challenges it will encounter in the near future. Further study may focus on topics, such as what kinds of problems the Chinese construction industry had encountered during each stage and what impacts these problems had brought to it, what challenges, such as environment and safety issues the Chinese construction industry will be facing if it continues to grow as its current tendency, and how Chinese construction firms will compete with foreign construction firms in the domestic market and in the global arena.

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