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Concentration Effect on Construction Firms: Tests of Resource Partitioning Theory among Jiangsu Province (China) from 1989 to 2007

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Abstract

Along with the economic acceleration and the consequent flourishing of urban infrastructure and real estate, there has been a tremendous development of the Chinese construction industry. The industry continues, however, to suffer from excessive competition and low profit margins. Based on the resource partitioning process of organizational ecology theory, which predicts how market concentration relates to the survival of specialist and generalist organizations, this study analyzes the structure and the structural effect of the Jiangsu construction industry. Using the event history analysis method and data on all companies known to have operated during the period 1989-2007, the survival of both large and small construction companies within this low but increasing concentration industry has been investigated. It is concluded that the increasing concentration of the Jiangsu construction industry is negative to the survival of construction companies. Nevertheless, no resource partitioning process can have occurred because it is found that the effect of concentration on decline for smaller companies is greater than for larger ones, and this violates the assumption of resource partitioning theory. In addition, macroeconomic, policies and factors at the level of the firm have proved significant in relation to the incidence of survival of Jiangsu construction companies. Although this research focused mainly on the major construction companies of one province of China, the result reflects the profile of the whole country to some extent and the research method could be replicated in other parts of the world for international comparisons. This would assist in

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understanding the structures of the construction industries in different countries and the structural effect on the survival of different types of firms.

Keywords: Construction industry, Concentration, Organizational ecology, Resource partitioning, Event history analysis, China

Introduction

Concentration refers to the resources in a market tapped or controlled by a small number of firms. The extent of concentration of a particular industry provides useful information on the degree and nature of market competition (Ratnayake 1999, Chiang et al. 2001). Many researchers in construction industry focus on concentration studies, as this labor-intensive industry usually suffered from low concentration and fierce competition (Langford and Male 2001). Chiang et al. (2001) examined the market concentration of four different sectors in the Hong Kong construction industry, founding the building sector was less concentrated than other sectors. McCloughan (2004) illustrated little concentration phenomenon in the British construction market. Zeng et al. (2005) investigated the concentration of the Chinese construction industry with Lorenz curve and Gini coefficient, discovering a very low concentration industry. Yang and Li (2008) concluded that the concentration of the Chinese construction industry is less than that of developed countries and of other industries in China. Ye et al. (2009) established a new model to measure the concentration of international

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construction market. It can be concluded that a number of research studies of concentration have been conducted in construction industry.

Concentration is derived from the structure-conduct-performance paradigm in the discipline of industrial economics (Clark 1985). As an important indicator for market structure, concentration has important impact on company performance. However, few researches addressed this effect on construction firms. Within the context of one province of China, this study mainly focuses on the concentration effect on different construction firms. Survival of construction firms in a low but increasing concentration environment will be analyzed, the rule of evolution process will be tested and the choice of positional strategies will be discussed.

Process of Resource Partitioning

Resource partitioning, one of the most important sub-theories in organizational ecology, mainly focuses on how market concentration relates to the mortality rates of specialist and generalist organizations (Park and Podolny 2000). It is widely known that there is a trend towards increasing market concentration in many industries (Carroll and Hannan 2000). Accompanying this trend, the traditional industrial economics argues that higher concentration is associated with higher profits for larger firms (Boone et.al 2002), while resource partitioning theory explains the combined trend of increasing mortality rates of generalist firms and decreasing mortality rates of

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specialist firms (Dobrev 2000). Resource partitioning assumed that market resources are distributed unevenly within and across relevant resource dimensions, which results in the centre of the market having abundant resources and the periphery having comparatively low resource levels (Carroll, et al. 2002). Firstly, there are many generalists (companies target a broad range of the market) seek to achieve the economies of scale and scope necessary to dominate the market's center. With competition, only few generalists possess the greatest scale and scope eventually dominating the market. Finally, diseconomies of scale and highly idiosyncratic preferences in the periphery, prohibit the few surviving generalists from serving the mass of demand in the center of the market and also serving the peripheral regions formerly occupied by the large number of generalists, thus, it creates the opportunities for the prosperity of specialist (companies need only a narrow band of resource types) in the peripheral market (Park and Podolny 2000).

Resource partitioning recognized the firm- and industry-specific characteristics, which not only focuses on the market structure effect, but also concentrates on the strategy and position of the firms. Though it violates the traditional industrial economics to some extent, many empirical research studies support the fact of this process, including the American beer brewing industry (Carroll and Swamianthan 1992 & 1993), the banking industry in Italy (Freeman and Lomi 1994), the newspaper industry (Dobrev 2000), the auditing industry (Boone et al. 2000), and automobile manufacturers (Dobrev et al. 2002). Nevertheless, little if not none of these studies

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have been applied to the construction industry. As a traditional industry, which usually suffered from low concentration, it is meaningful to test the resource partitioning process and investigate survival of different types of firms in this industry.

History Overview of China and Jiangsu Construction Industry

Since the 1980s, the reform and opening up policy of China has accelerated economic growth. As a result, this has led to the rapid development of urban infrastructure and housing construction, creating many construction activities, and rendering the Chinese construction market one of the most attractive in the world. According to the National Bureau of Statistics of China (2008), the output value of the Chinese construction industry increased from 28.7 billion RMB (1USD≈ 6.83 RMB in 2009) in 1980 to 5104.4 billion RMB in 2007, recording a rapid expansion of almost two hundredfold in this period. At the same time, the number of enterprises grew from 6604 in 1980 to 62074 in 2007. Despite these achievements, the low concentration and high competition have long hindered the development of this industry. Concentration ratio (CR_n) is the most widely used concentration index, which represents the percentage of the market share owned by the largest 'n' firms in an industry (Clark 1985). Shepherd (1982) argued that if the CR_4 is less than 60%, it will be classified as a competitive market, in which there are many firms, each selling an identical product. According to Table 1, the concentration ratio of Chinese

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construction industry keeps at a level which is lower than 14%, presenting the fierce competition in this industry. As a developed province in China, Jiangsu is famous for its construction industry. Its output value, profit, and, numbers of workers and companies have kept the top 3 in the whole country since 2001, and ranked first in 2007. Nevertheless, it also encounters the problems as the low concentration and severe competition. It can be concluded from Table 1 that the concentration ratio of Jiangsu remains at a low level from 1995 to 2007.

Insert Table 1 here: Concentration Ratio (CR4) of Chinese and Jiangsu Construction Industry

The Jiangsu construction industry mainly consists of three types of company: state-owned companies, collective-owned companies and mixed economy characterized companies. As shown in Table 2, the state-owned companies are usually large, while the mixed economy characterized companies are relatively small.

Insert Table 2 here: Comparison of Different Types of Jiangsu Construction Companies in 2007

It can be concluded from Table 2 that the labor productivity and rate of technical equipment of state-owned companies are higher than collective-owned and mixed economy characterized companies, presenting the higher efficiency of these

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companies. Considering the low concentration of Jiangsu construction industry, however, these large state-owned companies still survive in a competitive market. Yang et al. (2010) argued that the state-owned companies of Jiangsu province have been highly monopolized by nation before the reform and opening up policy. Though the state-owned companies have gradually stepped on a market-oriented rode from 1980s, they are still being influenced by government and policies to a large extent. The state-owned companies are usually criticized as lacking administrative and marketing abilities (Ministry of Housing and Urban-Rural Development of China, MOHURD 2008). Furthermore, because of the government and policies effect, exit barriers are high for them. Zeng et al. (2005) also argued that due to the deep-imprint of the planned economy, the market structure and competition environment of the Chinese construction industry is severely distorted, while the companies are laden with heavy policy-determined burden, resulting in excessive competition and low profitability in this industry.

According to the Table 2, the major component of Jiangsu construction industry are mixed economy characterized companies, accounting for a large proportion of both company number and output value of Jiangsu construction industry. Over the last two decades, the robust economic growth in China has boosted the demands on the construction industry. In this context, the companies characterized as 'mixed economy', whose major components are small township firms, have become the major engine driving the expansion of the Jiangsu construction industry (Yang et al.

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2010). As shown in Table 2, these companies are usually small in size, the labor productivity and the technology are low. In order to obtain works, these small construction firms have to lower their bidding price, sometimes leading to poor quality (Zeng et al. 2005).

Jiangsu government has carried out a series of actions to improve this traditional industry by establishing the plans as the"Three Large Strategies" (large industry, large company and large market) and "Three Adjustments" (profession structural adjustment, management structural adjustment and ownership structural adjustment). With these efforts, though it is still kept at a low level, the concentration of Jiangsu construction industry has improved step by step since 2000 (Table 1). Thus, it is meaningful to find whether hypotheses of resource partitioning theory do apply to this industry, whose concentration is still low but keeps improving. What are the companies' fate in this low concentration industry? Will the increasing concentration bring more opportunities to the specialist while it is a threat to the generalist? Based on the context of Jiangsu construction industry, these are the main investigative area of this study.

Data and Method

Data Sources

Information on those companies with more than 1000 employees at the end of the

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operating year was collected every year between 1989 and 2007 from the Jiangsu Province Construction Management Bureau. This is the period for which reliable information can be obtained and it also corresponds with the fastest-growing period of the Jiangsu construction industry.

Event History Analysis

In this research study, event history analysis was adopted when analyzing the resource partitioning process. This comprises a set of statistical methods that are designed to describe, explain and predict the occurrence of the events (Hardy & Bryman 2004). Unlike traditional time-series models, where a single entity is typically examined over time, nor the cross-sectional study, which relate to a single point in time, event history analysis focuses on the information gained from many observations over time. The major advantage of event history data is that it provides complete data, to the greatest possible extent, on changes in qualitative variables that may occur at any point in time (Blossfeld and Rohwer 2002). As resource partitioning is an evolutionary process that focuses on many companies, whose properties change over time, event history analysis is an appropriate choice for the study of resource partitioning. Based on a review of the earlier empirical studies of resource partitioning, the piecewise constant-rate exponential model was selected in order to analyze the mortality risk applying to construction companies. This is a model which allows the effects of time to vary over pre-selected time periods, while baseline probabilities are estimated

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for each time period (Blossfeld and Rohwer 2002). The dependent variable in this model is the risk of mortality, which is defined as:

$$r(t) = \lim_{dt \to 0} \frac{\Pr(exit, t + dt | no \quad exit \quad by \quad t)}{dt} \tag{1}$$

where $r(t)$ is the instantaneous risk measure of mortality, and $\Pr(.)$is the probability of a construction company having to leave the industry between $t + dt$, conditional on the company being active at t. The general form of the piecewise constant-rate exponential model is defined as:

$$r(t) = \exp(\alpha_l + \alpha A) \tag{2}$$

For each transition, α_l is a constant coefficient associated with the lth time period. A is a row vector of variables and α is an associated vector of coefficients assumed not to vary across different periods of time.

Data Structure

To apply the event history analysis method in this paper, a "company-year" data structure has been utilized (Du 2008). With this method, the active company is observed every year and an entry is made for each observation. As this study focuses on the resource partitioning process between 1989 and 2007, companies still in operation at the end of this period were regarded as "censored" cases. Censoring is an important methodological concept that should be considered in event history analysis. It occurs when the full event history of an observation is not available at the time of observation (Box-Steffensmeier and Jones 2004). To explain the

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meaning of censoring fully, the cases of two construction companies are illustrated below. The last observation point for them was 2007. Assuming that one of the companies survived beyond 2007 but the other went out of business in 2007. The status of both companies would be classified as "mortality", because their last records both end at 2007. To distinguish the survival companies from those which actually went out of business in 2007, those which survived beyond 2007 are considered as "censored". A dummy variable is added to distinguish the "censored" data from other data, in order to effectively eliminate bias during the analysis process (Du 2008).

Variable Definition and Measurement

Dependent Variable

The "event" in event history analysis represents a change or transition from one state or condition of interest to another (Box-Steffensmeier and Jones 2004). In this study, the "event" is a firm dropping from the company list of Jiangsu Province Construction Management Bureau. The firms come through this event will be defined as "decline", implying a company failing to anticipate, recognize, avoid, neutralize, or adapt to external or internal pressures that threaten the organization's long-term survival (Koksal and Arditi 2004). This definition has been adopted in this study instead of the mortality to analysis the process of resource partitioning for three

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reasons. Firstly, Hannan and Freeman (1989) defined the mortality of organization as ceasing to carry out routine actions that sustain its structure, maintain flows of resources and secure the allegiance of members. As Jiangsu province collects the data of company employees more than 1000 as a list, it is reasonable to define the companies which cannot maintenance their members above 1000 as a phenomenon of decline. Secondly, the Chinese construction industry is a labor intensive industry, and more employees mean more projects and more profits, thus, the companies that cannot retain their employees are supposed to affect their long-term survival as "decline". Thirdly, the small construction companies of Jiangsu construction industry are usually short-lived, and obscure, and the data is hard to be collected. Also, in 2007, there are 972 companies with more than 1000 employees, accounting for nearly 70% of output value of Jiangsu construction industry, while the last 6045 companies take the other 30% of output value. The companies which cannot be published on the list can be considered as trivial in the Jiangsu construction industry. Based on this definition, the data set contains 8193 "company-year" entries for more than 2500 companies operating in the period of 1989 to 2007. All the companies data enter into the analysis, and the "decline" companies every year is shown in Table 3 (The data of 2007 is censored data):

Insert Table 3 here: Description of Dependent Variable (1989-2006)

Independent Variables

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For the analysis of resource partitioning process, definitions of three independent variables are important:

- *Generalist and Specialist*

Although there is no definite connection between whether an organization is generalist or specialist and its size, it implies that generalist organizations are usually larger than specialist organizations (Dobrev 2000). Many earlier research studies also supported this assumption. In a study of Dutch auditing firms, for example, Boone et al. (2000) argued that, contingent on industry characteristics, variations in organizational size can be equated with the distinction between generalists and specialists. Likewise, in a study of the Bulgarian newspaper industry, Dobrev (2000) also established that generalists are larger in size, and specialists are smaller. He pointed out that generalists target their products towards several resource segments, and are often of large size in consequence, while the specialists predominantly focus on the periphery of the market, where the available resources tend to be few. The latter are often small in size. Though this experience has not been proven in construction industry yet, according to the common situation, it is sensible to consider that the general construction firms are large in size, while the special construction firms are small. Thus, instead of generalist and specialist companies, the distinctness between large companies and the small ones is where the inherent lies in this study. The size of the company has been chosen as the indicator to judge the large and small

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companies, while this size is presented by natural logarithm of the output value of each construction company.

- *Industry Concentration*

In this study, the concentration ratio (CR_n) has been chosen as an index to present the industry concentration of Jiangsu construction industry:

$$CR_n = \sum_{i=1}^{n} S_i \quad (3)$$

where S_i is represented by the construction output value. In order to achieve a better description of concentration and aid analysis of the resource partitioning process, both CR_4 and CR_8 were calculated in this study. The modeling results based on these two indicators will be compared, and the better one will be adopted for the further analysis.

- *Multiple Effect*

In order to analyze the interaction of organizational size and concentration degree on the survival of construction firms, a variable was computed for both CR_4 and CR_8 by multiplying the concentration ratio figure with the organizational size figure.

Control Variables

Based on a review of the research studies on the mortality of organizations, Van Kranenburg et al. (2002) argued that three categories of factor influence the mortality

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of an organization, including: (a) macroeconomic effects; (b) industry-specific factors; and (c) company-specific variables. Furthermore, to capture the special characteristics of the Chinese government, macro policies are also recognized as an influencing factor.

- *Macroeconomic effects:* Both National and Jiangsu province data on GDP, fixed-asset investment and construction output were collected. In addition, since the real estate is a flourished industry which is highly correlated to construction industry activities and the Jiangsu province's building projects are widespread in the country, both national and Jiangsu province variables related to real estate were selected. All these factors were introduced in the form of growth rates.

- *Industry-specific factors:* Not only the structure of the industry can influence the mortality of the firms, but also its density. To capture the effect of the density dependence process, which depicts the non-monotonic relationship between density and rates of organizational mortality (Hannan and Carroll 1992), linear and squared terms for the total number of Jiangsu construction companies were included.

- *Company-specific variables:* The age of a company, which is defined as the length of time a company exists in a particular organizational population (Hannan et al. 1998), is introduced as a company-specific variable. As the study focused

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on the period 1989 to 2007, the age of companies in 1989 were taken as one, in 1990 as two, and so on its subsequent years. For the piecewise constant-rate exponential model analysis, company age should be split into 'n' segments. Cheng (2007) argued for a better estimate results, each of the segments needs to contain approximately the same number of companies. Calculating for several times, the companies were split into four segments. Each of the segments contains approximately the same number of companies. The first segment (0,1) includes dated events occurring in the first year; the second (1,3) contains dated events occurring in the 2nd and 3rd years; the third segment (3,5) and the fourth segment (>5) are defined similarly.

- *Macro Policies:* The effect of the reform and opening up policy, the transformation of Chinese state-owned enterprises and enter into WTO are incorporated in this research study as they are recognized as the most important policies influencing the development of the industry (Xu et al. 2005, Yang et al. 2010). Three dummy variables for these relevant periods were further added: (1) the reform and opening up policy from 1989 to 1997; (2) the transformation of Chinese state-owned enterprises from 1998 to 2001; and (3) the entrance into WTO in 2001.

Modeling

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Based on the model and variable definitions, the resource partitioning process can be formally represented by the following model:

$$r(t) = \exp\left(\alpha_1 + \gamma_1 SIZE + \gamma_2 CR_n + \gamma_3 \left(SIZE * CR_n\right) + BX\right) \quad (4)$$

According to the previous definition, α_l is the constant coefficient associated with the four age segments. The Size, CR_n denotes the process of the resource partitioning. The last term BX specifies the effect of control variables on the decline rate. Before the analysis of resource partitioning process, correlations between these variables were investigated.

Insert Table 4 here: Correlation Matrix

As shown in Table 4, GDP, fix-asset investment, and construction output of Jiangsu province were eliminated from the model, due to the high correlation with other variables (Xie and Li 2008).

Model A and model B are introduced as baseline models, which exclude the process of resource partitioning. With interaction of size and concentration, model C and model D are established as complete models, including all variables in Equation 4. Furthermore, in order to develop a comparative study and to obtain a better result, both CR_4 and CR_8 were introduced as a measurement of concentration. CR_n is represented by the 4-firm concentration ratio (CR_4) in model A and model C, and the

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8-firm concentration ratio (CR_8) in model B and model D. A maximum likelihood estimation procedure was employed for event history analysis using SPSS 15.0.

Findings

Table 5 presents the estimate of the four organizational mortality models using the Jiangsu construction industry data from 1989 to 2007. As shown in Table 5, the results deduced from CR_4 and CR_8 are similar. As a result, analyzes of the resource partitioning process are mainly based on the results calculated from CR_4.

Insert Table 5 here: Piecewise Constant-Rate Exponential Model of Jiangsu Construction Industry Mortality

Independent Variables

It is manifest from Table 5 that the main effects of the independent variables on the resource partitioning process are significant. The coefficients for both CR_4 and CR_8 show positive and significant results as expected, which demonstrates that increase of concentration levels will increase the decline of construction companies. Nevertheless, as shown in model C, the signs for organizational size and interaction variables are opposite to those expected. The resource partitioning theory argues that with increasing concentration, generalists (larger companies) tend to compete vigorously for the center of the market, thus allowing specialists (smaller companies)

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to thrive on the periphery, which implies that though the mortality of both large and small companies rises with concentration, the rate of rise for smaller companies is slower. This phenomenon, however, is not supported by this study. As shown in Table 5, the combined coefficient linking CR_4 and organizational size is negative and significant, which implies that the effect of concentration on decline will be smaller for larger companies than for smaller ones. This is also supported by Fig. 1. The multiplier here is a measurement of proportional effect of the given combinations of organizational size and industrial concentration on the risk of "decline", which can be defined as (Carroll, et al. 1993):

$$M(Multiplier) = \frac{\exp(0.837SIZE + 3.621CR_4 - 0.273SIZE * CR_4)}{\exp(0.837SIZE_{\min} + 3.621CR_{4\min} - 0.273SIZE_{\min} * CR_{4\min})} \quad (5)$$

Insert Fig. 1 here: Effect of resource partitioning on mortality rate of Jiangsu construction companies

Control Variables

Regarding the control covariates, a few estimates are worth noting. Firstly, as can be observed by comparing the estimates for the 4 age intervals of the piecewise constant-rate model, age dependence in the Jiangsu construction industry is significant as expected. Hannan (2005) argued that as young organizations have to learn new roles and become familiar with social actors; to deal with external clients, customers and other relevant actors; as well as to compete with well-established existing

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organizations, new organizations are more likely to fail. This "liability of newness" has been proved to exist in many previous research studies. Secondly, the density dependence process shows a significant effect on the survival of the construction companies as both density variable parameters are significant in four models. This convinced the prediction of Yang et al. (2010) that the density dependence process shaped the survival of Jiangsu construction industry. Thirdly, based on the results of model C, it can be concluded that except for the variable of completed floor space of Jiangsu, all macroeconomic coefficients proved to be significant. The GDP of China, the fixed-asset investment of China, the construction output of China, the national completed of real estate investment and the floor space under construction of Jiangsu all show negative and significant results as expected. This means a good macroeconomic environment can offer more opportunities to all of the existing companies, which could reduce the risk of decline hazard for all companies. However, the coefficients for the dummy of reform and opening up policy, the transformation of state-owned companies and enter into WTO are positive and significant, which are opposite to the expected. Perhaps these periods bring opportunities as well as additional challenges to the Jiangsu construction industry (Xu et al. 2005). Enterprises have to face risks of bankruptcy, acquisition, and operation failure as well as damage to reputation, which were rather rare experiences in the time of the planned economy.

Discussions

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Although the research findings of this study are at variance with those normally associated with the resource partitioning process, it provides a result which is meaningful in the case of the particular structure of the Jiangsu construction industry. The resource partitioning theory focuses not only on the process of resource distribution, but also on the relative positions of organizations. It assumes that resources, which are unevenly distributed, can be divided into centered and peripheral regions. With the process of concentration, the large and small companies begin to move to the appropriate resource position. The viability of an organization depends not only on its size, but also on its position or location within the environment (Carroll et al. 2002). In a study of a Dutch daily newspaper, Boone et al. (2004) argued that in the resource partitioning context, success also depends on the newspaper's position in resource space. The successful newspaper is either squarely positioned in the center (large generalist) or finds a viable niche at the resource periphery (small specialist). Nevertheless, it seems that such portioning of large and small companies is not significant in the Jiangsu construction industry.

Insert Fig. 2 here: Output Value Distribution of Jiangsu Construction Industry (2000-2007)

It can be concluded from Fig.2 that within the dimension of product, the Jiangsu construction industry mainly consists of the four sectors of, construction work,

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decoration work, installation work, and others. The main sector of Jiangsu construction industry is construction works, which occupied more than 80% of output value of Jiangsu construction industry from 2000 to 2007. As the market contains more bountiful resources which are considered as market centre (Carroll et al. 2002), the market of construction works is defined as the market centre for Jiangsu construction industry. While the market of installation works, decoration works and others are considered as peripheral regions in this study. Based on output values, information of the top 10 and the bottom 10 Jiangsu construction companies (2001-2007) were collected. As shown in Fig. 3 and Fig. 4, though they are very different in size (output value), the main product of both top 10 and bottom 10 firms are construction works.

Insert Fig. 3 here: Work distribution of top 10 construction companies of Jiangsu province (2001-2007)

Insert Fig. 4 here: Work distribution of bottom 10 construction companies of Jiangsu province (2001-2007)

While concerned about the resource dimension of work, most companies play a role as building contractor, while the general contractors are few. It can be concluded from the output value of the Jiangsu industry, in 2007, the self-product output value of Jiangsu construction industry is 651 billion, while sub-contract output value is only

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2.8 billion. Zeng et al. (2005) argued that the large firms of Chinese construction industry should act as general contractors while the small firms serve as subcontractors. However, the unreasonable market structure, imperfect legal environment, and poor credibility system has hindered cooperation of large and small construction companies (Huang 2007).

As a whole, it can be concluded that both the large and small construction companies of Jiangsu construction industry crowd in the same position, which is coincident with the first stage of resource partitioning (Park and Podolny 2000). Companies in this stage usually show "scale-based" phenomenon, as size relative to competitors matter more than other characters to the survival of companies (Carroll et al. 2002). The theory of 'liability of smallness' argues that small organizations have greater difficulty in raising capital, labor input and resisting risk, thus have higher risk of mortality (Aldrich & Auster 1986). Based on this theory, the smaller organizations of the Jiangsu construction industry, which crowd in the market center with the larger firms, have greater risk of decline than the larger companies, as has been proved in this study. This phenomenon becomes more obvious with the acceleration of concentration level as shown in Fig. 1. Since the raising of the concentration level is accompanied by the growth of the large companies, more pressure is exerted on the survival of the small companies competing in the same resource market.

As mentioned in the previous analysis, the Jiangsu construction is experiencing a

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boom market. Its industrial structure, however, seems to remain in the first stage of resource partitioning process, indicating an immature industry. Thus, it is essential for the Jiangsu construction industry to establish a multi-level competition structure, promote the "partitioning" process, and encourage the collaboration between large and small companies. Boone et al. (2000) referred to four categories of resource partitioning: (1) the first category has a concrete geographical meaning, such as the airline passenger service industry; (2) the second category is identified by technological partitioning, such as beer brewing; (3) the third category is closely related to differences between the products, such as music recording, book publishing and the newspaper industry; and (4) the fourth category resembles the auditing industry, which focuses more on customization. These partitioning patterns suggest four ways for the further development of the Jiangsu construction industry:

- ***Location partitioning.*** Since the main property of a construction product is its immobility, the location of the market is important. Traditionally, the location level of the construction market can be divided into local, regional and national markets. In recent years, the continued booming of the international construction market has provided a new and profitable outlet for construction companies in China. Zeng et al. (2005) referred to the hierarchy competition of the Chinese construction industry. That is, the industrial giants of the Jiangsu construction industry can act as general contractors whose activities spread internationally as well as nationally; the medium-sized firms serve the regional market as building contractors; and the small

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firms act in the local market as professional contractors. The above represents a reasonable structure for the location partitioning of this industry.

- ***Technology partitioning.*** Clark (1985) stated that capital-intensive/high technology sectors tend to be highly concentrated while more traditional labor-intensive sectors are not. As high technology enhances the entry barrier and reduces competition in the industry, technology partitioning is necessary for the Jiangsu currently labor-intensive construction industry. In this way, the large companies with more capital and strength could enhance their management ability and technology in procuring large and complicated projects, and small companies could turn to professional technologies for special but fertile projects.

- ***Product partitioning***. Industrial economics theories have considered that an industry with more categories of product would be more profitable (Clark 1985). As revealed in this research study, the product category of the Jiangsu construction industry is too simple, and this causes the serious competition and low profit margins. Based on the above analysis, the advent of product partitioning is necessary to this industry. Large companies with capital and advanced technology could focus on the larger and more profitable engineering projects. While small companies could serve the decoration and installation market. Despite small project sizes, profitability and survival chances are higher than in the crowded building market.

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- ***Customers partitioning.*** Under the planned economy, the only client for Chinese construction is Government. With the development of the market economy, however, clients have become more diversified, including the Government, itself, into regional and other public bodies, housing developers, private companies, and international investors. With the growing adoption of new contract models, such as DB (design-build), PPP (public-private-partnership) and BOT (build-operate-transfer), the relationships between contractors and clients have become more complicated, generating more dimensions for resource partitioning between large and small companies.

In addition, as the construction companies are influenced by the government to a large extent, it is the government's task to perfect the market structure, enhance the management of qualification, improve the law system for sub-contract, and reduce the risk of cooperation. With these actions, the system of the industry will mainly include four levels as: general contractor, construction contractor, professional contractor and labor services contractor.

Conclusion

Based on the resource partitioning analysis of the Jiangsu construction industry, it can be concluded that the increasing of concentration has negative effect on the survival of both large and small construction companies in the Jiangsu province.

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Nevertheless, it is further discovered that no resource partitioning process has occurred, as both the large and small company crowd in the same position. In this context, smaller companies suffer from a greater risk of decline than larger companies. The best choice for the companies of Jiangsu construction industry companies is to cooperate and carry on a resource partitioning process within the four dimensions of location, technology, product and customer, and to choose the appropriate resource market. Though only one province of China was selected in this study, the results do identify some structural problems of the Chinese construction industry as well as the effects of the present structure on the survival of its large and small companies. A major limitation of this research study is that due to the data limitation, only the major companies of the Jiangsu construction industry can be analyzed. However, it still proved some interesting and meaningful understanding of the industry. The research method of this study could be replicated in other places for international comparisons, thus assisting in the understanding of the structure of construction industries in a global context.

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Table 1 Concentration Ratio (CR_4) of China and Jiangsu Construction Industry

Year	China	Jiangsu Province	Year	China	Jiangsu Province	Year	China	Jiangsu Province
1995	11.67%	7.71%	2000	9.59%	5.37%	2005	12.06%	7.20%
1996	8.72%	5.20%	2001	9.71%	5.51%	2006	13.06%	7.12%
1997	8.80%	4.48%	2002	9.17%	6.15%	2007	13.44%	6.34%
1998	9.34%	6.02%	2003	10.57%	6.43%			
1999	9.79%	4.19%	2004	10.95%	7.10%			

Table 2 Comparison of Different Types of Jiangsu Construction Companies in 2007

		State-owned	Collective-owned	Mixed economy characterized
Size (Million RMB)	Average Output Value	237.5	109.1	89.2
	Average Asset	157.6	68.2	58.6
Efficiency (RMB/Person)	Labor Productivity	243669	166174	155852
	Rate of Technical Equipment	27285.27	7292.52	8931.12
Proportion of Jiangsu (%)	Number	6.46	2.91	90.64
	Output value	15.35	3.17	81.48

Table 3 Description of Dependent Variable

Year	Number of Company	Number of Decline	Year	Number of Company	Number of Decline	Year	Number of Company	Number of Decline
1989	103	8	1995	224	30	2001	654	205
1990	114	10	1996	313	50	2002	588	123
1991	112	3	1997	336	48	2003	708	148
1992	133	12	1998	330	79	2004	718	147
1993	141	7	1999	328	49	2005	783	173
1994	225	43	2000	556	115	2006	858	176

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Table 4 Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.Size																
2.C_4	0.293															
3.C_8	0.338	0.938														
4.Density	0.375	0.569	0.712													
5.Density^2/1000	0.352	0.549	0.682	0.977												
6.GDP of China(Growth Rate)	0.060	0.578	0.483	0.017	0.076											
7.GDP of Jiangsu(Growth Rate)	0.039	0.541	0.472	0.015	0.093	0.640										
8.Fixed-Asset Investment of China	0.100	0.564	0.518	0.247	0.304	0.510	0.730									
9.Fixed-Asset Investment of Jiangsu	0.027	0.363	0.338	0.072	0.102	0.321	0.667	**0.867**								
10.Construction Output of China	-0.014	0.277	0.194	-0.125	-0.095	0.435	**0.752**	0.651	0.521							
11.Construction Output of Jiangsu	0.015	0.465	0.342	0.042	0.118	0.526	**0.896**	**0.802**	0.595	0.659						
12.National Completed of Real Estate Investment	0.121	0.363	0.333	0.381	0.369	-0.159	0.029	0.002	0.150	-0.165	0.057					
13.Floor Space Under Construction of Jiangsu	0.207	0.705	0.668	0.499	0.532	0.405	0.727	0.696	0.652	0.342	**0.799**	0.429				
14.Completed Floor Space of Jiangsu	0.099	0.350	0.342	0.222	0.242	0.504	0.594	0.573	0.306	0.377	**0.751**	-0.151	0.680			
15. Dummy for Reform and Opening Up Policy	-0.296	-0.366	-0.471	-0.466	-0.668	0.235	0.315	-0.003	0.067	0.375	0.150	-0.355	-0.311	-0.142		
16. Dummy for Transformation of State-Owned Companies	-0.068	-0.453	-0.505	-0.209	-0.293	-0.404	-0.557	-0.524	-0.474	-0.380	-0.340	-0.048	-0.336	-0.054	-0.278	
17. Dummy for Enter into WTO	-0.051	-0.190	-0.296	-0.181	-0.197	-0.228	-0.259	-0.223	-0.261	-0.047	-0.070	-0.111	-0.106	-0.018	-0.151	0.542

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Table 5 Piecewise Constant-Rate Exponential Model of Jiangsu Construction Industry Mortality

Variable	Model A	Model B	Model C	Model D
Age: 4 periods				
0-1	-4.152** (1.391)	-2.509*(1.312)	-19.781*** (2.769)	-20.139***(2.530)
1-3	-4.914***(.076)	-.3.269*** (.076)	-20.557***(.076)	-20.913*** (.076)
3-5	-4.910***(.098)	-3.271*** (.098)	-20.540***(.098)	-20.892*** (.098)
> 5	-5.258***(0.96)	-3.611*** (.096)	-20.899***(.096)	-21.255*** (.096)
Size	-.838***(.043)	-.831*** (.042)	.837*** (.255)	1.068***(.231)
CR_4	.562***(.113)		3.621*** (.483)	
CR_4*Size			-.273*** (.042)	
CR_8		.340*** (.091)		2.448***(.275)
CR_8*Size				-.188***(.023)
Density	.001***(.001)	.003*** (.001)	.003*** (.001)	.002**(.001)
$Density^2$/1000	-.0003***(.00013)	-.0002*** (.0001)	-.0002*** (.0005)	.0001**(.0005)
GDP of China(Growth Rate)	-.033***(.007)	-.031*** (.008)	-.026*** (.007)	-.023**(.008)
Fixed-Asset Investment of China(Growth Rate)	-.091***(.021)	-.099*** (.022)	-.074*** (.022)	-.076***(.022)
Construction Output of China(Growth Rate)	-.044***(.011)	.050***(.012)	-.037***(.011)	.041***(.012)
National Completed of Real Estate Investment (Growth Rate)	-.026**(.009)	.017 (.009)	-.032*** (.009)	-.024**(.009)
Floor Space Under Construction of Jiangsu(Growth Rate)	-.116***(.027)	-.082 ***(.025)	-.121*** (.027)	-.091***(.025)
Completed Floor Space of Jiangsu(Growth Rate)	.023(.015)	-.019 (.015)	.043(.015)	.012(.015)
Dummy for Companies that are Censored	1.649*(.669)	3.435*(.750)	.634***(.692)	1.785***(.755)
Dummy for Reform and Opening Up Policy (1989-1997)	.793**(.275)	.624*(.272)	.553*(.274)	.380(.269)
Dummy for Transformation of State-Owned Companies (1998-2001)	.717***(.178)	1.056***(.222)	.426*(.182)	.657**(.221)
Dummy for Enter into WTO	.846***(.196)	1.137***(0.220)	.711*** (.193)	.917***(.211)
Chi-square	3659.863	3649.183	3703.395	3719.013
Degree of Freedom	19	19	20	20
Number of Company-Year Episode	8195	8195	8195	8195

Standard errors are in parentheses

*p<.05 , **p<.01 , ***p<.001

Fig.1.pdf

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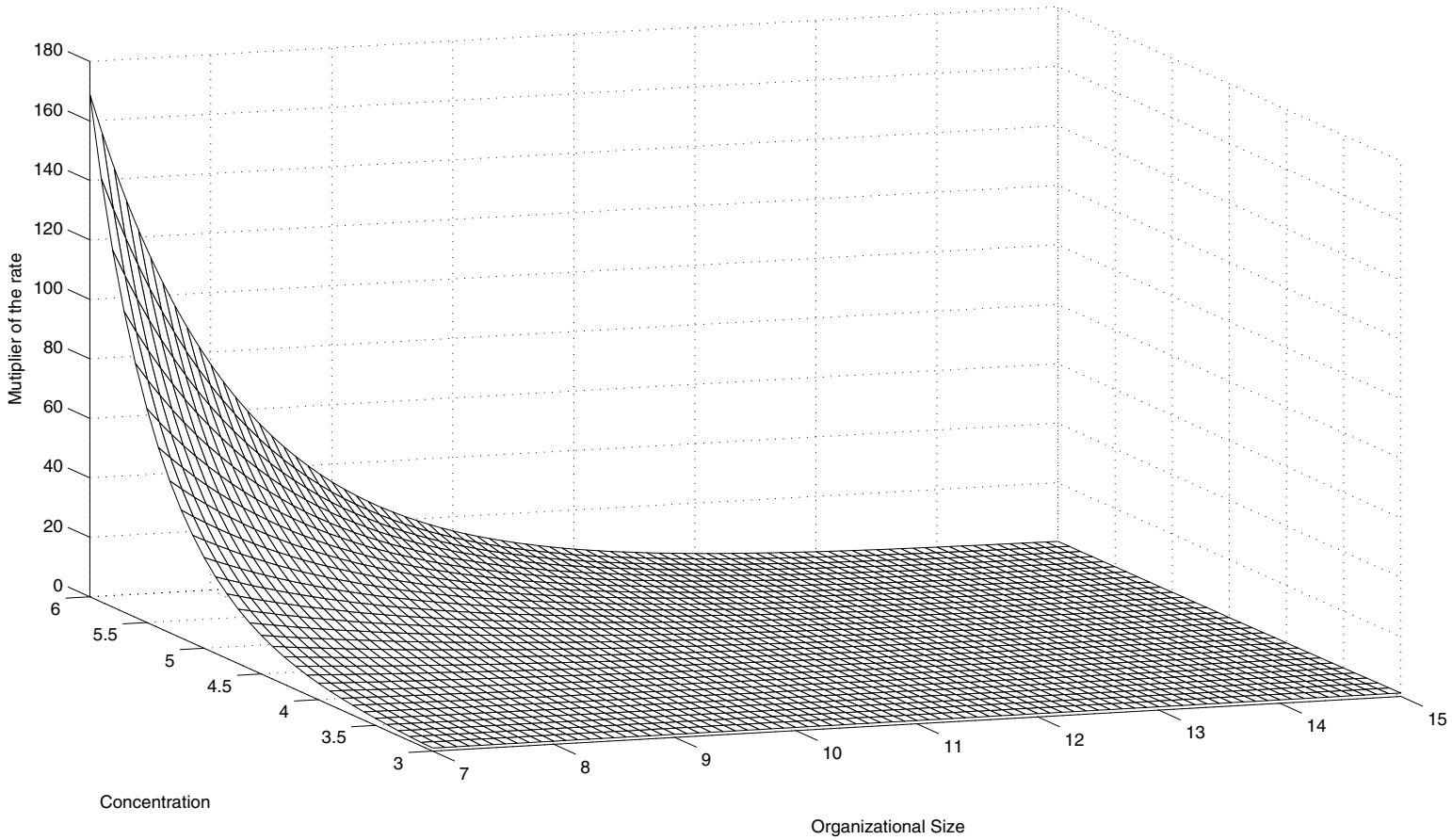

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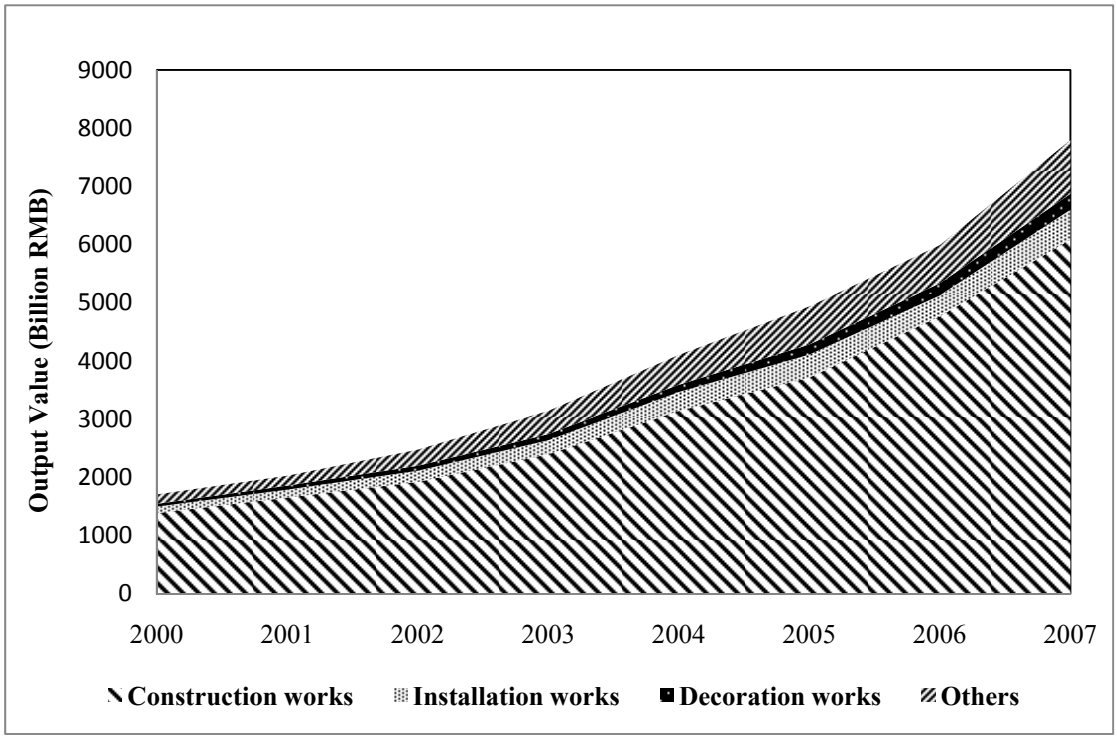

Fig.3.pdf

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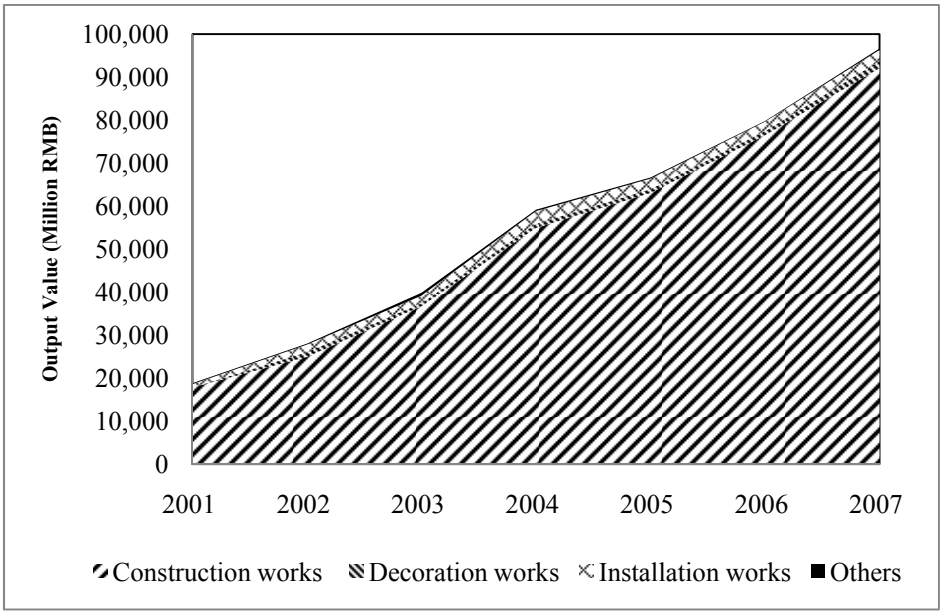

Fig.4.pdf

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