Niche Width, Competitive Positioning and Performance of International Construction Contractors (1992-2009)

* Huan Yang[1], Albert P.C. Chan[2], John F.Y. Yeung[3]

* Corresponding author.
E-mail address: yang.huan@mail.shufe.edu.cn (Huan Yang)
Telephone number: 86-021-6590-4204

1 Lecturer, Institute of Finance and Economics Research, Shanghai University of Finance and Economics, Shanghai, China.

b Professor and Associate Dean, Faculty of Construction and Environment, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China.

c Lecturer I, College of International Education, School of Continuing Education, Hong Kong Baptist University, Hong Kong, China.

Abstract

Over the past few decades, the international construction industry has proved a dramatic development. However, the unstable international circumstance has enhanced the risks of this industry, where proper strategies are critical for the survival of international contractors. Based on organizational ecology theories, which initially stemmed from ecology and then introduced to business management and economics field, proper competitive positioning for international construction companies are investigated in this study. Niche width has been introduced as an indicator to reflect the resource utilization of international construction companies while location is defined as the contractors' distance from the market center. Using Engineering News-Record data on top 225 international contractors from 1992 to 2009, the U-shaped relationship between niche width and performance of contractor is proved in both product and geography dimensions, indicating the performance of contractors enhance with the expansion of niche width initially, and then subside. In addition, location shows significant effect on performance of international contractors. The proper location for contractors with narrow niche width is close to the geographic market center and far from the product market center; while the appropriate positions for contractors with wide niche width are opposite to those with narrow niche width. Although this research focuses mainly on top international contractors, the results may reflect the profile of the whole industry. Furthermore, the research method of this study could be replicated in other studies to enhance the understanding of the organizational competitive positioning in a complicated environment.

Keywords: international construction market, international contractors, competitive positioning, niche width, resource partitioning

Introduction

Over the last decades, the world has witnessed a dramatically expansion of international construction industry. The globalization of the world economy, fast transportation and convenient communications have all helped to lower traditional barriers and transform construction into a flourished but competitive international marketplace. According to statistics published by the Engineering News-Record (ENR)(2011), the international revenue of ENR's top 225 international contractors (TIC 225) has reached $383.7 billion in 2010, representing a three-fold increase over the US$106.5 billion in 2001.

However, recently uncertain international environment such as unpredicted recession and recovery have all heavily hit the development of the international construction industry as well as the contractors enrolling in this market. ENR (2011) reported that the international contractors are enduring difficult economic conditions. As traditional strong markets are declining, many contractors are looking for the new regions and new growth point. Jung et al.(2012) demonstrated that international contractors will show quite different performance in this uncertainty environment even though they may achieve similar revenue performances in the boom period. In such a circumstance, a proper competition positioning is critical for the survival of international contractors.

Competitive positioning defines a firm's relative posture in a competitive space. It enables a firm to create a defensible position by making offensive or defensive moves based on the firm's characters and the environment (Kale and Arditi 2002). Many researchers and studies have been involved in this topic. Based on Porter's 5 forces model, diamond framework and Dunning's eclectic paradigm, Han et al. (2010) investigated the strategies for contractors to sustain growth in the global construction market. It was found that contractors tend to response to the changing markets by increasing their overseas revenues and enhancing their competency through more diversified products. With a combined perspectives of strategy choice and environmental determinism theories, Korkmaz and Messner (2008) compared competitive positions of Turkish and U.S. construction firms in international markets. Low and Jiang (2004) analyzed and compared international contractors' competition strategies and performances within the framework of Dunning's eclectic paradigm. Besides, tremendous studies on the strategies of contractors have been conducted with SWOT analysis (strengths, weaknesses, opportunities and threats) (Lu 2010; Lu et al. 2009; Zhao and Shen 2008).

The debates on competitive positioning can be addressed into two categories, environmental determinism and strategic choice perspectives (Korkmaz and Messner 2008). The environmental arguments are in favor of environment driven structures for the survival of organizations. It emphasizes the evolutionary role of nature, arguing that a proper position or environment is the primary mechanism to explain the performance of an organization (Hannan and Freeman 1989). While the strategic choice perspectives consider that a better competitive position is achieved from deliberate planning, calculation and formulation

instead of the unpredictable environment. Whittington (2001) classified the traditional Porter's generic strategies into the strategic choice perspectives, and the organizational ecology theory into the environmental determinism category. The main difference between these two theories is the process they concerned with. Porter's generic strategies follow the strategic choice discipline, highlight deliberate processes, and demonstrate how the performance of the company is determined by endogenous factors, such as the organizational structure, product categories, managers' decisions etc. Korkmaz and Messner (2008) opined that Porter's generic strategies mainly investigate the strategic analysis, strategic plan and strategic choice process and their effects on the performance of organizations. On the contrary, the organizational ecology is concerned more with the emergent process of environmental selection, which considers environment as the primary mechanism to explain the performance of an organization (Whittington 2001).. The environment here is a nonobjective conception, which indicates the survival environment of the companies. Within a proper environment, organizations are more likely to obtain better performances. Meanwhile, the selection effect of environment tends to eliminate organizations within non-proper environment (Boone and Witteloostuijn 1995). With this selection effect and evolution, some organizations are sustained while others are eliminated. The diversity of organizational forms are caused by the environmental selections while the managers do not make choice (Hannan and Freeman 1989). These assumptions are stemmed from Darwinian perspective in ecology field. Carroll and Hannan (2000) considered that organizational ecology recognize the exogenous factors (environment resources and the fit with the environment) as the key determinants. Therefore, compared with other mainstream strategic management theories, organizational ecology is

categorized as environmental determinism typology . By using organizational ecology, this study analyzes the international proper competitive positioning from a environmental selection perspective. Resource utilization of international contractors and its location in the international resource environment are the main concerns in this study.

Niche width theory and resource partitioning theory are two main sub theories in organizational ecology. Both of them concern on the important conception of “niche”. Niche is initially defined by ecologists as “the many ranges of condition and resource qualities within which the organism or species persists”(Tisdell and Seidl 2004). Similar to its conception in ecology, the niche in organizational ecology is denoted as a proper statue or competitive positioning for organization to survive or gain better performances. Mainly based on the niche width theory and resource partitioning theory, the remainder of this paper is structured into four parts. Firstly, history of the international construction industry is reviewed in product and geography dimensions. Secondly, original niche width theory and resource partitioning theory are introduced. By following these theories, hypothesizes are proposed in the international construction context. Thirdly, following a description of data source, dependent, independent and control variables in this study are defined separately. And a growth model is chose to test the predictions. Fourthly, based on the data and methodology, implications among the niche, position and the performance of international contractors are detected, discussed and concluded.

Historical Overview of the International Construction Industry

Normally, international construction is defined as where a company, resident in one country, performs work in another country (Ngowi et al. 2005). Likewise, according to ENR, international construction is the part of construction business that is achieved by companies from projects outside their respective home countries. Although most international construction companies have business both in the international and their domestic market, the concept helps to investigate construction business from an international perspective by focusing their performance in the overseas market (Lu et al. 2009).

According to ENR, international construction resources can be divided into eight parts in terms of its product dispersions, including general building, manufacturing, power, water/sewer waste, industrial process/petroleum, transportation, hazardous waste, and telecommunication. From geography perspective, multinational construction can be further divided into six regional segments: North America, Europe, Latin America, Asia, the Middle East and Africa. The evolutions of these markets are shown in Figure 1 and 2.

It can be concluded from Figure 1 and 2 that the international construction market soared up around the year of 2002. The main supports for the flourish of international construction in this period are strong business of developed countries, and continue investing intending of developing countries with their own money and foreign investors' cash in infrastructure. Besides, this round of growth also benefits from the Euro, Japanese Yen, and several other currencies surging against the U.S. Dollar, which has boosted the TIC 225 revenues (ENR, 2007).

As Figure 1 and 2 shown, general building, industrial process/petroleum and transportation are the three most important sub-markets in international construction, while the Europe, Asia and Middle East are the most flourished sub-market in the geography dimension of international construction industry. These sub-markets with the most prolific resources are supposed to be the market center in the international construction market.

Nevertheless, it also noticed from Figure 1 and 2 that the ascending trend for international construction industry has stopped in 2008. The complicated international circumstance has intensified the risk of this industry. First of all is the fluctuated economic environment. For example, the financial tsunami in 2008 and following European sovereign-debt crisis have all heavily hit the international construction market. Secondly, steadily rising material price and personnel cost exerts much pressure on international contractors. Thirdly, fluctuant currency is another emerging risk factor for international contractors (Dikman et al. 2007; Han et al. 2010; Lu et al. 2009). Considering these adverse factors, a proper competitive position is crucial for international contractors.

Theories and Hypotheses

Original niche width theory and resource partitioning

Hannan and Freeman (1977) firstly defined the niche width of an organization as its variance in resource utilization. In terms of this conception, organizations pursuing strategies based on

performance over a wide range of environmental resources possess a wide niche width and would be classified as **generalists**, whereas organizations following strategies based on performance within a tight band of resources hold narrow niche width and are considered as **specialists**. In this study, the resources are assigned as market resources. International contractors who straddle a number of market segments, for example, general building, transportation, power etc., are termed as generalists. While contractors who focus on one or a few market segments are defined as specialists.

Resource partitioning is another important theory in organizational ecology which is highly related to niche width theory. Carroll (1985) established resource partitioning theory, explaining how market concentration relates to the mortality of generalists and specialists. It is assumed that environmental resources are distributed unevenly within and across relevant dimensions. The joint distribution of the unevenly environmental resources forms the market centre with abundant resources and the periphery associated with comparatively low resource levels (Carroll et al. 2002). At the beginning of the industry, all organizations are crowded in the center of the market. With competition, only a few organizations survive and possess the greatest scale and scope, resulting in large generalists finally. At the same time, highly idiosyncratic preferences in the periphery area prevent the generalists from serving this area, creating survival opportunities for specialists. Increasing concentration of the industry are predicted to intensify this process, indicating that fewer generalists control the power in the market center, and the survival space for the specialists in the peripheral area are more feasible. It further presents by increasing mortality rate of generalists and

declining mortality rate of specialists, accompanied with ascending of concentration.

Organizational niche width and performance

Boone et al. (2009) advocated that one of the most necessary boundary conditions set for resource partitioning is that there is a clear market centre where the scale or scope advantages could be large enough to ignite size-based competition among generalist organizations. Generalists in market center may not be burdened by straddle of different resource fragments. For example, products in international construction range from general building, transportation to industrial and petroleum projects. Though it seems to straddle several different resource fragments, the similarities among these markets are obvious both in terms of technological competencies and commercial market (Carroll et al. 2002).The international contractors with wide niche width may benefit their performance with scale or scope advantages.

Meanwhile, the peripheral area is supposed to be dissimilar or heterogeneous enough to prevent generalists straddle the market centre and peripheral niches at the same time (Boone et al. 2009), indicating that international contractors straddle two or more dissimilar resource fragments may pay a price in terms of overhead or excess capacity. Thus, contractors have to give up some resources in peripheral area to ensure their most benefit market resources. Thus,

Hypothesis 1*: The performance of international contractors will firstly enhance with the increase of niche width, and then subside.*

Organizational niche width, location and performance

As emphasized in resource partitioning theory, environment resources are divided into central and peripheral area. Center of the market is considered to occupy more resources than the peripheral area. Therefore, relative location to the market center becomes another important variable for the performance of contractors. Dobrev et al. (2002) has demonstrated that with market concentration enhancement, the effect of location away from the market center on organization's hazard of mortality shifts from positive to negative, offering an important reference for this study. On the one hand, market center is prolific with resources and opportunities. On the other hand, however, market center also attracts a large amount of competitors, resulting in high mortality rate for most of the companies which cannot sustain the power in center place. Since fierce competition is a common feature in the international construction industry (Ye et al. 2009), the competition threaten is considered as the dominant power in the center of the market, thus:

Hypothesis 2a*: The performance of international contractor improves with the distance away from the center of the market.*

Dobrev et al. (2002) observed that a location in the resource-rich sector provides

generalists with the potential to reap scale advantages, it is more likely for them to be centrally located when compared with other firms. Furthermore, generalists are more likely to offset the serious competition in center with success in less competitive regions covered by their "big" niche width span. Carroll et al. (2002) emphasized that for generalists, center of the market is their destination, as the idiosyncratic and barren periphery does not support its "big" niche width. In contrast, specialists located in the center of the market are more likely to encounter the threat of mortality than their generalist competitors as their assets are fully exposed to the intense competition. Baum and Singh (1994) also opined that generalists represent a greater competitive threat to specialists. Based on the above discussions of niche width theory and resource partitioning theory, it is reasonable to accept that:

Hypothesis 2b*: The effect of location away from the center of the market to enhance contractors' performances is negatively moderated by the niche width of the international contractors.*

Organizations will be adversely affected when they violate their organizational form's identity characteristics (Swaminathan 2001), such as position in resource spaces. The relationship between niche width and location is a substantial understanding for resource partitioning theory. Besides, this study will also test whether the classical hypothesis of resource partitioning is appropriate for international contractors:

Hypothesis 3*: The performances of generalists are reduced by the concentration of the market, while the performances of specialists are improved by the concentration of the market.*

Data and Method

Data source

The main data set for this study comes from the *Engineering News-Record* (ENR). ENR provides a comprehensive and historical database of international construction activities and the major actors (Drewer 2001). ENR annual survey started in 1979 following the expansion of international demand for construction. It collects data for top international contractors 225 (TIC 225), including total revenue, international revenue, sub-market revenue of each firm and comments on regions and markets, as well as industry view and prediction. The data on construction activities are usually poor and erratic both in domestic and international contexts (Ruddock 2002; Ye et al. 2009), ENR, however, offers a relatively objective and comprehensive historical database for studies on international construction. Though it only collected the data of top international contractors 225, Ye et al. (2009) argued that contractors outside the top 225 have negligible market power, and have little involvement in overseas works and international market.

The international contractors of this study mainly based on TIC 225. In order to have a comprehensive understanding of international contractors, both product and geography

dimensions are involved. The empirical setting for product study is from 1992 to 2009, while the setting for geography dimension is from 2004 to 2009, charting the time frame of this study.

Dependent variables

The performance of international contractors are usually quantified by absolute measures such as market shares, profitability, or turnover (Cuervo and Low 2004). However, most of these indicators often lack integrity and standardization across different countries to evaluate and compare international contractors' actual performance. As this paper mainly focuses on the contractors' performance in the international construction market, indicators that relate to their international performance are preferred. With ENR database, the international revenue of contractor was chosen to measure the performance (***per.***) of international contractors in this study. Though this indicator may not comprehensively reflect the performance of contractors, it is the most available and trusted indicator since ENR is one of the most important historical databases in international construction studies. Furthermore, it offers the possibilities to compare contractors from different countries at the same level. With international revenue data of international contractors, Low et al. (2004), Korkmaz and Messner (2008) have compared the performance of international contractors.

Independent variables

Both dimensions of product and geography are important in niche width calculation in this

282 study. For the product niche width of organization i ***(NW_{ip})***, this study follows Hannan and
283 Freeman's (1989) definition on the niche width as:

284 $$NW_{ip} = -\sum_{r=1}^{R} u_r \log u_r \qquad (1)$$

285 where u_r stands for the revenue of product r within the total international revenues. R is
286 total number of products, including general building, manufacturing, power, water/sewer
287 waste, industrial process/petroleum, transportation, hazardous waste, and
288 telecommunication.

289

290 Because of a data limitation of ENR, revenue data for each sub-market in geography
291 dimension cannot be collected, the formula (I) for ***NW_{ip}*** cannot be applied to geography
292 niche width of organization i (***NW_{ig}***). Proxy calculation has to be made to overcome this
293 limitation. The span covered by the niche has been introduced to reflect the resource
294 utilization of the company. With this method, Baum and Singh (1994) defined the niche
295 width of day care center as the span of ages that they are licensed to enroll. Dobrev et al.
296 (2001) and Dobrev et al. (2002) characterized the technology niche of an automobile
297 manufacturer as the difference in sizes between the largest and smallest engines that they
298 produce. This study, similarly, defines the NW_{ig} as geographical span of organization i:

299 $$NW_{ig} = n / N \qquad (2)$$

300 Where n is the number of countries that organization i entered in, N is the total number of
301 countries with multinational activities in.

302

303 Market center is an important factor for the measurement of organizational location, which

has to be ensured firstly. According to Dobrev et al.'s (2001) definition, which assumes that the largest organizations form the market center, it thus can be defined as:

$$Center_r = E4_r^{\min} + (E4_r^{\max} - E4_r^{\min}) / 2 \quad (3)$$

where $Center_r$ represents center for product/geography r. For product analysis, for example, $E4_r^{\min}$ is the minimum revenue of product r among the top four TIC 225, while $E4_r^{\max}$ is the maximum revenue of product r among the top four firms. For geographical calculation, r denotes the six regional markets, including North America, Europe, Latin America, Asia, the Middle East and Africa. $E4_r^{\min}$ is the minimum project number in region r among the top four, and $E4_r^{\max}$ is the maximum project number in region r among the top four firms. With this definition, centers for both product and geography dimensions have been confirmed as Figure 3 and Figure 4.

Although fluctuating, it can still be concluded that the market center in product dimension is general building, transportation and industrial process/petroleum, and that market center for geography dimension is Europe, Asia and Africa. This result is highly matched with the historical overview of international construction industry, indicating these sub-markets possess more resources than others.

The location of contractor i ($\boldsymbol{L_i}$) is defined as its distance away from the market center. According to the definition of centers, location of contractor is calculated by Euclidean distance. Log-transformed has been taken to smooth the data in this study:

$$L_i = \ln \sqrt{\sum_{r=1}^{R} (U_r - Center_r)} \quad (4)$$

For contractor i's L_{ip} in product dimension, U_r is revenue of product r (r=1,…,9), while for L_{ig} in geographical dimension, U_r is numbers of project in region r (r=1,…,6).

Concentration ratio (CR_4) as a normal index to represent the concentration of an industry, has been chosen in this study to calculate the concentration of the multinational construction industry (McCloughan 2004):

$$CR_4 = \sum_{i=1}^{4} S_i \tag{5}$$

Where S_i is represented by the international revenues of company i. Top four MNCCs have been chosen every year for calculation of this variable.

Interactive variables have been introduced as ***NW*L*** and ***NW*C₄*** (Hannan et al. 1998; Hannan et al. 1998), in order to reflect the interactive effect of niche width (NW) and location of contractor (L), and the interaction of industry concentration (C_4) and niche width (NW) in shaping the international contractors' performance.

Control variables

The control variables have been corrected for the effect of covariates at both the macro environment level and micro individual level. At the macro environment level, as mentioned above, performance of international contractors have been deeply influenced by the world economy, thus, logarithm form of Gross Domestic Product of the world has been selected to control for changes of the world economy, expressed as ***GDP*** in this study. At

the micro individual level, years for an international contractor has been listed in the top international contractors 225 are chosen as a control variable to reflect the ***Experience*** of an organization. The years here mean international contractor are backward to the earliest year that can be reached, which is 1982 in this study. For example, if an international contractor was listed in the top international contractors 225 in 1982, and continued to appear in the top international contractors 225 till 1992, its experience was computed as 11 years.

Based on the definitions above, descriptive statistics for the variables are shown as Table 1.

Insert Table 1 here: Descriptive statistics

Modeling

Observations of this study are structured as a pooled cross-sections (contractors) and time-series (1993-2009 or 2004-2009) data set. Following Barnett (1994), Barron et al. (1994) and Boone et al. (2004)'s methodology, *growth models* have been chosen for estimation in this study. The proportional growth rate ($Performance_{t+1} / Performance_t$) is assumed to depend on (a) the performance at time t and (b) an exponential function of independent variables impinging on that growth rate. To simplify estimation, such growth models are log-transformed, implying estimation models of the following type (Boone et al. 2004):

$$\ln(Per._{i,t+1}) = \theta \ln(Per._{i,t}) + \gamma_{i,t} + \varepsilon_{i,t+1} \quad (6)$$

with

$$\gamma_{i,t} = X_{i,t}\pi \quad (7)$$

where $X_{i,t}$ represent independent and control variables for company i at time t.

Furthermore, considering the panel database structure in this study, *fixed effect model* has been chosen for analysis. According to Boone et al. (2004), this model has been chosen for following reasons, as (a) it is an appropriate method to deal with the standard problem of autocorrelation generally resulting from the pooling of cross-sections and time-series data (Barron et al. 1994); (b) it is a conservative estimate as it controls for any type of unobserved heterogeneity across organizations. As the database structure of this study contains large cross-section data (225 organizations for each year) but short time-series (18 years for product analysis, 6 years for geography analysis), cross-section effect becomes a more important effect that should be focused on. Thus, Hausman test has been taken for cross-section effect (Gao 2007). With Eviews 5.0, it is found that for all models, random effect has been rejected (Gao 2007), cross-section fixed model has been chosen in this study. With Eviews 5.0, results are shown in Table 2.

Finding

Insert Table 2 here: Fixed-effect model for top 225 international contractors

As Table 2 shown, hypothesis 1 has been proved by model 1 & 2 for product and geography dimensions separately, and hypothesis 2a has been tested by model 3 & 4 on product and geography dimensions. Furthermore, the interactive effect of distance away from the market center and niche width has been testified by model 5 & 6 in product and geography dimension respectively. Finally, model 7 has been established to investigate the resource partitioning process in the product dimension.

It is manifested from Table 2 that hypothesis 1 has received strong support in both product and geography dimensions. As model 1 and model 2 shown, one term effect for both product and geography dimensions are significant and positive, while quadratic term are proved to be significant and negative, indicating the inversely U-shaped relationship between niche width and their performance in both product and geography dimensions. This conclusion can also be visually supported by Figure 5. The multiplier (M) here is a measurement as proportional effect of the given niche width on the performance of international contactor, which can be defined as (Carroll et al. 1993):

$$M(Multiplier) = \frac{\exp(C + \alpha_1 NW_i + \alpha_2 NW_i * NW_i)}{\exp(C + \alpha_1 NW_{\min} + \alpha_2 NW_{\min} * NW_{\min})} \quad (8)$$

As can be seen from Figure 5, the expansion of niche width in both product and geography dimension can benefit international contractors' performance. However, this effect turns to be in opposite direction when the extreme value is overturned. Based on function 8 and coefficients in model 1 & 2, the turning point of M is mainly determined by "$c+\alpha_1 NW_i+\alpha_2 NWi* NW_i$". The function can be specified as "$c+0.608\ NW_i\ -0.629$

412 NW_i*NW_i" by using the results in model 1, the NW_i value at the turning point of product
413 dimension is then calculated as NWe=0.608/(0.629*2)=0.483. The extreme value of NW_i at
414 the geography dimension can be estimated in the similar way with the results in model 2,
415 which turn out to be 0.531. These niche width (0.483 in product dimension and 0.531 in
416 geography dimension) are the turning points of the inversed U-shaped curve in Figure 5. It
417 suggests that for most international contractors, when their niche width are smaller than the
418 extreme value, increasing NW_p and NW_g will probably improve their performances.
419 However, when the extreme value is surpassed, further expansion of NW_p and NW_g are
420 presumably deleterious to their performance.
421
422 As reported in Table 2 (model 3 & 4), location has shown a significant effect on
423 performance of organization, though the result in geography dimension is opposite to
424 product dimension. Coefficient of L_p (models 3) is positive and significant as expected,
425 indicating the distance away from the center of the market will relieve competition pressure
426 of an organization and improve its performance. However, the coefficient of L_g has shown
427 significant but negative results, demonstrating the location away from the market center in
428 geography dimension may reduce the performance of international contractors.
429
430 At the same time, it is worth noting that the interactive coefficients are significant but
431 opposite for product and geography dimensions as shown in model 5 & 6, suggesting the
432 proper competitive position or strategies for an international contractor is quiet different in
433 product market and geography market. Multipliers (M) of the NW and L on the

contractor's performance have been calculated as:

$$M(Multiplier) = \frac{\exp(C + \alpha_1 NW_i + \alpha_2 L_i + \alpha_3 NW_i * L_i)}{\exp(C + \alpha_1 NW_{\min} + \alpha_2 L_{\min} + \alpha_3 NW_{\min} * L_{\min})} \quad (9)$$

Based on function 9 and coefficients from model 5 and 6, the interactive effect in product dimension and geography dimension has been shown as Figure 6 and Figure 7 respectively. It can be concluded that the results for product and geography dimensions are opposite.

Concerning the specialists in the product dimension, the expansion of distance away from the product center will improve their performance as Figure 6 implied. However, this effect is moderated by the niche width. According to the function 9 and results of model 5, when NW_p>0.557 (the turning point of **M** is mainly determined by "$c+\alpha_1 NW_i+\alpha_2 L_i+\alpha_3 NW_i * L_i$". By using the results in model 5, the function can be written as "$C+2.629\ NW_i+0.157 L_i -0.282 NW_i * L_i$", which can be further transformed to "$C+2.629\ NW_i+(0.157-0.282 NW_i) * L_i$". When the NW_i exceed the value of 0.157/0.282=0.557, the expansion of L_i will transfer from a positive effect to a negative effect on organizational performance. The calculation of the geography dimension is in the same way, the expansion of L_p will change from a positive effect to a negative effect on organizational performance. It supports the hypothesis of resource partitioning theory that generalists should locate in the center of the market, while specialists residing in the peripheral area are more likely to achieve good performance. Nevertheless, the results in the geography dimension have shown a contrary trend. As can be seen from Figure 7, the distance away from the geography center is accompanied with decline of performance for specialists, which is opposite to hypothesis

2a. NW_g again is a pivotal variable to reshape the relationship between L_g and organizational performance. As demonstrated in Figure 7, the negative effect of L_g on performance will transfer to positive effect when the NW_g achieves at 0.557. This conclusion in the geography dimension is contradict to the judgment of Yang and Lu (2013), which proved that the most appropriate niche for international contractors at both product and geography dimensions is a broad niche width and locate near to the market center. Nevertheless, the ideal conditions may not always happen. As "growth model" is adopted in this study, increment of international revenue is emphasized in this study. The results in this study indicate that the cause of increment of international revenue is different in product and geography dimensions. In the geography dimension, the specialists locate close to the market center and generalists stay away from the market center are more likely to predict a growth in their international revenue, while the condition in the product dimension is opposite.

Because of the data limitation, concentration ratio in geography dimension cannot be calculated in this study. Thus, only resource partitioning process in product dimension has been tested. Based on Table 2 (model 7), coefficients for both NW_p and interactive variables are not significant, indicating the resource partitioning process is not effective in multinational construction industry. Furthermore, it is worth noting that the coefficient for C_4 is significant and negative, suggesting the enhancing of concentration may bring down the performance of international contractors.

With caution about the control variables, it can be concluded that both GDP of the world and the experience of an organization show a significant and positive effect on contractors' performance, which prove that both the prosperous economy environment on macro level and rich experience of micro level can promote the performance of international contractors.

Discussion

According to the results in this study, a number of key findings warrant further discussion. Firstly, it is manifested from Figure 5 that there is an extreme value for the expansion of niche width for international contractors. Contractors with a niche width around this extreme value tend to gain better performances, which is accord with Kale and Arditi (2002)'s conclusion that contractors with a neutral approach to scope of competition are superior in their performances. The contractors with a too broad niche width may also harmful for their performances. However, have the international contractors achieved this extreme value? Based on data of TIC 225, NW_p and NW_g for main contractors in 2009 have been calculated.

Insert Table 3 here: Average niche width for top 225 international contractors in 2009

It can be concluded from Table 3 that most contractors in the international construction market still have a lot of opportunities to enhance their niche width in both product and geography dimensions, as most average value for international contractors are smaller than

the extreme value. Han et al. (2010) have proved that by increasing the proportion of overseas revenues and enhancing the diversity of products, contractors are more likely to sustain their growth in the international construction market.

Dunning (2000) has specified the ownership advantages of international companies as special capabilities that mainly gain from the resources and capabilities of their home countries. With these advantages, companies are more likely to achieve superior performance in the international market. This phenomenon has also been detected in the construction industry. It can be seen from Table 3 that most contractors from developed countries have wider niche width in both product and geography dimensions. With better technology, management capacity, and financial skills, contractors from developed countries are more competitive to take advantage of the global development (Ngowi et al. 2005). Besides, with long history of internationalization, they are believed to accumulate more experiences. Their costs to straddle different resource fragments may be smaller, while the scale advantages are more likely to be magnified. Compared with their experienced competitors, contractors from developing countries, for example China and Turkey, show relatively narrow average niche width in both dimensions as Table 3 represented, suggesting their limited abilities that can only control and straddle few resources in the international construction market.

Secondly, as mentioned above, center of the market is a double-edges sword, which is characterized by prolific resources and fierce competition at the same time. Concerning

product dimension, competition threat prevail the resource attraction in the product center, as distance away from the market center is proved to be positive for organizations as a whole. Meanwhile, generalists possess more advantages than specialists in the center of product dimension because of their wide distribution of products can offset the competition threat to some extent. Thus, they are more likely to locate in the center of the market to utilize profuse resources and gain scale advantages just as indicated in Figure 6.

In the geography dimension, it is supposed that the center of the market mainly show glamour, since the distance close to the market center will enhance the performance of organizations. In contrast to product dimension, specialists seem to do better in geography center than their general competitors. It considered that resources in geography dimension are quiet dissimilar because of different environments, economics, politics and cultures among countries, where generalists have to pay much to straddle different resource fragments and are hard to gain scale advantages. However, specialists may conquer these disadvantages with their professional focus. Furthermore, it can be concluded from Figure 4 that the market center of geography is mainly composed by developing regions, such as Africa, Asia and Middle East, where have large requirement of construction activities. Specialists, usually come from developing regions (Low and Jiang 2004) are more convenient to carry work in these regions with similar culture, language background and low transportation costs. Thus, specialists concentrate to geography center while generalists locate away from the center of the market are predicted to gain good performances.

Overall, it can be concluded that specialists are more likely to achieve a better performance

by residing in a location which is close to the market center in geography dimension and far from the market center of product dimension, while generalists tend to achieve good performances in a location which is near to the market center in product dimension and is far away from the market center in geography dimension. Thus, the proper niche for the special international contractors can be summarized as market centers such as Europe, Asia and Africa in geography dimension, and manufacturing, power, water/sewer waste etc. in the peripheral area of product market; while the proper niche for the general international contractor is opposite to those of the specialists.

Conclusion

With a new perspective from organizational ecology theory, the proper competitive positioning of international contractors has been investigated. Niche width and performance of international contractors show inversely U-shaped relationship in both product and geography dimensions. The location of contractors has significant effect on the performance of contractors, in spite of a diverse observation in product dimension and geography dimension. Contractors locating in the peripheral area of product dimension (manufacturing, power, water/sewer waste, hazardous waste and tele-communication) and scattering in the center of geography dimension (Europe, Asia and Africa) are more likely to gain high performance. In addition, the interactive effect of niche width and location also shows significant but opposite results in product and geography dimensions, indicating that the proper competitive positioning for the special contractors are areas close to the market center of geography dimension and far away from the market center of product dimension, while the

proper competitive positioning for the generalists are opposite to those of the specialists.

With a nature selective perspective, this study provides a new understanding of organizational niche, competitive positioning and performance of international contractors. By examining contractors' abilities to occupy various resources, taking account of their location to the market center, and observing their match with the resource environment, this study has critically analyzed the proper competitive positioning for international construction companies. Compared with the traditional analytical methods, niche theory in organizational ecology framework succinctly puts international construction companies into their macro and nonobjective resource environment. Although this study only focuses on the construction industry, similar research method could be replicated for other industries, thus contributing to the understanding of the relationship between organizations and their survival environment.

References

Barnett, W. P. (1994). "The liability of collective action: growth and change among early American telephone companies." *Evolutionary Dynamics of Organizations*, J. A. C. Baum, and J. V. Singh, eds., Oxford University, New York, 337-354.

Barron, D. N., West, E., and Hannan, M. T. (1994). "A time to grow and a time to die: growth and mortality of credit unions in New York City, 1914-1990." *American Journal of Sociology*, 100, 381-421.

Baum, J. A. C., and Singh, J. V. (1994). "Organizational niches and the dynamics of organizational founding." *Organization Science*, 5(4), 483-500.

Boone, C., Carroll, G. R., and van Witteloostuijn, A. (2004). "Size, differentiation and the performance of Dutch daily newspaper." *Industrial and Corporate Change*, 13(1), 117-148.

Boone, C., Meuwissen, R., and van Witteloostuijn, A. (2009). "Resource-partitioning processes in the audit industry." *Strategic Organization*, 7(3), 307-338.

Boone, C., and Witteloostuijn, A. (1995). "Industrial organization and organizational ecology: the potentials for cross-fertilization." *Organization Studies*, 16(2), 265-298.

Carroll, G. R. (1985). "Concentration and specialization: dynamics of niche width in populations of organizations." *American Journal of Sociology*(90), 1262-1283.

Carroll, G. R., Dobrev, S. D., and Swaminathan, A. (2002). "Organizational processes of resource partitioning "

596 *Research in Organizational Behavior*, 24, 1-40.
597 Carroll, G. R., and Hannan, M. T. (2000). *The demography of corporations and industries*, Princeton University
598 Press, Princeton.
599 Carroll, G. R., Preisendoerfer, P., Swaminathan, A., and Wiedenmayer, G. (1993). "Brewery and brauerei: the
600 organizational ecology of brewing." *Organization Studies*, 14(2), 155-188.
601 Cuervo, J. C., and Low, S. P. (2004). "Global performance measures for transnational construction
602 corporations." *Construction Management and Economics*, 22(10), 851-860.
603 Dikman, I., Birgonul, M. T., and Han, S. (2007). "Using fuzzy risk assesement to rate cost overrun risk in
604 international construction projects." *International Journal of Project Management*, 25, 495-505.
605 Dobrev, S. D., Kim, T. Y., and Carroll, G. R. (2002). "The evolution of organizational niches: U.S. automobile
606 manufacturers, 1885-1981." *Administrative Science Quarterly*, 47(2), 233-264.
607 Dobrev, S. D., Kim, T. Y., and Carroll, G. R. (2002). "Niches and scale in organizational evolution: A unified
608 empirical model of automobile manufacturers in the U.S., 1885-1981." *Administrative Science*
609 *Quarterly*, 47, 233-264.
610 Dobrev, S. D., Kim, T. Y., and Hannan, M. T. (2001). "Dynamics of niche width and resource partitioning."
611 *American Journal of Sociology*, 10(5), 1299-1337.
612 Drewer, S. (2001). "A perspective of the international construction system." *Habitat International*, 25(1),
613 69-79.
614 Dunning, J. H. (2000). "The eclectic paradigm as an envelope for economic and business theories of MNE
615 activity." *International Business Review*, 9(2), 163-190.
616 Engineering News Record (2007). "The top 225 international contractors." *ENR*, 259(8), 30-36.
617 Gao, T. (2007). *Econometric analysis and modeling: Eviews applications and examples*, Tsinghua University
618 Press, Beijing, China.
619 Han, S. H., Kim, D. Y., Jang, H. S., and Choi, S. (2010). "Strategies for contractors to sustain growth in the
620 global construction market." *Habitat International*, 34(1), 1-10.
621 Hannan, M. T., Carroll, G. R., Dobrev, S. D., and Han, J. (1998). "Organizational mortality in European and
622 American automobile industries part I: Revisiting the effects of age and size." *European Sociological*
623 *Review*, 14(3), 279-302.
624 Hannan, M. T., Carroll, G. R., Dobrev, S. D., Han, J., and Torres, J. C. (1998). "Organizational mortality in
625 European and American automobile industries part II: Coupled clocks." *European Sociological*
626 *Review*, 14(3), 303-313.
627 Hannan, M. T., and Freeman, J. (1977). "The population ecology of organizations." *American Journal of*
628 *Sociology*(82), 924-964.
629 Hannan, M. T., and Freeman, J. (1989). *Organizational Ecology*, Harvard University Press, MA.
630 Jung, W., Han, S. H., and Lee, K.-W. (2012). "Country portfolio solutions for global market uncertainties."
631 *Journal of Management in Engineering*, 28(4), 372-381.
632 Kale, S., and Arditi, D. (2002). "Competitive positioning in Untied States Construction Industry." *Journal of*
633 *Construction Engineering and Management*, 128(3), 238-247.
634 Korkmaz, S., and Messner, J. I. (2008). "Competitive positioning and continuity of construction firms in
635 international markets." *Journal of Management in Engineering*, 24(4), 207-216.
636 Low, S. P., and Jiang, H. B. (2004). "Estimation of international construction performance: analysis at the
637 country level." *Construction Management and Economics*, 22(3), 277-289.
638 Low, S. P., Jiang, H. B., and Leong, C. H. Y. (2004). "A comparative study of top British and Chinese
639 international contractors in the global market." *Construction Management and Economics*, 22(7),

717-731.

Lu, W. (2010). "Improved SWOT approach for conducting strategic planning in the construction industry." *Journal of Construction Engineering and Management*, 136(12), 1317-1328.

Lu, W. S., Li, H., Shen, L. Y., and Huang, T. (2009). "Strengths, weaknesses, opportunities, and threats analysis of Chineese construction companies in the global market." *Journal of Management in Engineering*, 25(4), 166-176.

McCloughan, P. (2004). "Construction sector concentration: evidence from Britain." *Construction Management and Economics*, 22(9), 979-990.

Ngowi, A., Pienaar, E., Talukhaba, A., and Mbachu, J. (2005). "The globalisation of the construction industry-a review." *Building and Environment*, 40(1), 135-141.

Reina, P., and Tulacz, G. J. (2011). "The top 225 international contractors." *Engineering News Record*, 266(8), 45-66.

Ruddock, L. (2002). "Measuring the global construction industry: improving the quality of data." *Construction Management and Economics*, 20(7), 553-556.

Swaminathan, A. (2001). "Resource partitioning and the evolution of specialist organizations: The role of location and identity in the U.S. Wine industry." *Academy of Management Journal*, 44(6), 1169-1185.

Tisdell, C., and Seidl, I. (2004). "Niches and economic competiton: implications for economic efficiency, growth and diversity." *Structural Change and Economic Dynamics*, 15, 119-135.

Whittington, R. (2001). *What is Strategy—and Does it Matter*, Thomson Learning, London.

Yang, H., and Lu, W. (2013). "Niche comparisons: toward a new approach for analysing competition and organizational perfomrance in the international construction market." *Construction Management and Economics*, 31(4), 307-321.

Ye, K. H., Lu, W. S., and Jiang, W. Y. (2009). "Concentration in the international construction market." *Construction Management and Economics*, 27(12), 1197-1207.

Zhao, Z. Y., and Shen, L. Y. (2008). "Are Chinese contractors competitive in international markets?" *Construction Management and Economics*, 26(3), 225-236.

Table 1 Descriptive statistics

Variables	Mean	SD	Minimum	Maximum	Number of observation
Ln(Performance)	5.194	1.783	-1.204	10.173	4050
Niche $Width_p$	0.271	0.214	0	1	3971
Niche $Width_g$	0.089	0.099	0	1	1350
$Location_p$	8.517	0.452	7.009	9.538	4012
$Location_g$	3.266	0.248	1.445	3.515	1331
Concentraction	0.212	0.046	0.147	0.299	4050
GDP	31.213	0.283	30.830	31.746	4050
Experience	6.541	6.202	1	29	4050

Table 2 Fixed-effect model for top 225 international contractors

Variable	H1		H2a		H2b		H3
	Model 1 (NW_P)	Model 2 (NW_G)	Model 3 (L_P)	Model 4 (L_G)	Model 5 (NW_P*L_P)	Model 6 (NW_G*L_G)	Model 7 （NW_p*C_4）
Constant(C)	-26.411[c]	-44.192[c]	-25.603[c]	-48.349[c]	-25.645[c]	-47.447[c]	-25.438[c]
	(1.635)	(3.474)	(1.703)	(3.628)	(1.724)	(3.741)	（1.681）
Ln(Performance)	0.466[c]	0.385[c]	0.470[c]	0.392[c]	0.464[c]	0.381[c]	0.464[c]
	(0.016)	(0.028)	(0.016)	(0.028)	(0.016)	(0.028)	(0.016)
Niche Width	0.608[b]	3.092[c]			2.629[b]	-2.547[a]	0.073
	(0.222)	(0.666)			(1.027)	(1.896)	(.253)
Niche Width^2	-0.629[a]	-2.913[a]					
	(0.327)	(1.190)					
Location			0.059[a]	-0.591[c]	0.157[b]	-0.685[b]	
			(0.028)	(0.126)	(0.047)	(0.234)	
Niche Width*Location					-0.282[a]	1.230[a]	
					(0.120)	(0.574)	
Concentration							-0.766[a]
							(0.411)
Niche Width*Concentration							0.715
							(1.097)
GDP	0.935[c]	1.509[c]	0.896[c]	1.707[c]	0.869[c]	1.687[c]	0.910[c]
	(0.054)	(0.113)	(0.058)	(0.122)	(0.059)	(0.132)	(0.055)
Experience	0.005[a]	0.015[c]	0.006[a]	0.017[c]	0.007[a]	0.017[c]	0.007[a]
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
Adjusted R^2	0.906	0.955	0.905	0.954	0.906	0.954	0.906
Cross-section	618	323	620	321	618	321	618
Total panel (unbalanced)	3417	1142	3444	1129	3417	1129	3417

a. Standard errors are in parentheses

b. [a]$p<0.05$, [b]$p<0.01$, [c]$p<0.001$

c. Independent variables are lagged one period

Table 3 Average niche width for top 225 international contractors in 2009

	Extreme Value	Top International Contractors 225	US	Japan	Korea	China	Turkey	UK	Germany	France	Italy	Spain
Niche Width$_p$	0.483	0.285	0.241	0.337	0.311	0.218	0.279	0.365	0.563	0.358	0.275	0.351
Niche Width$_g$	0.531	0.095	0.153	0.097	0.063	0.085	0.032	0.096	0.232	0.360	0.111	0.135

Figure
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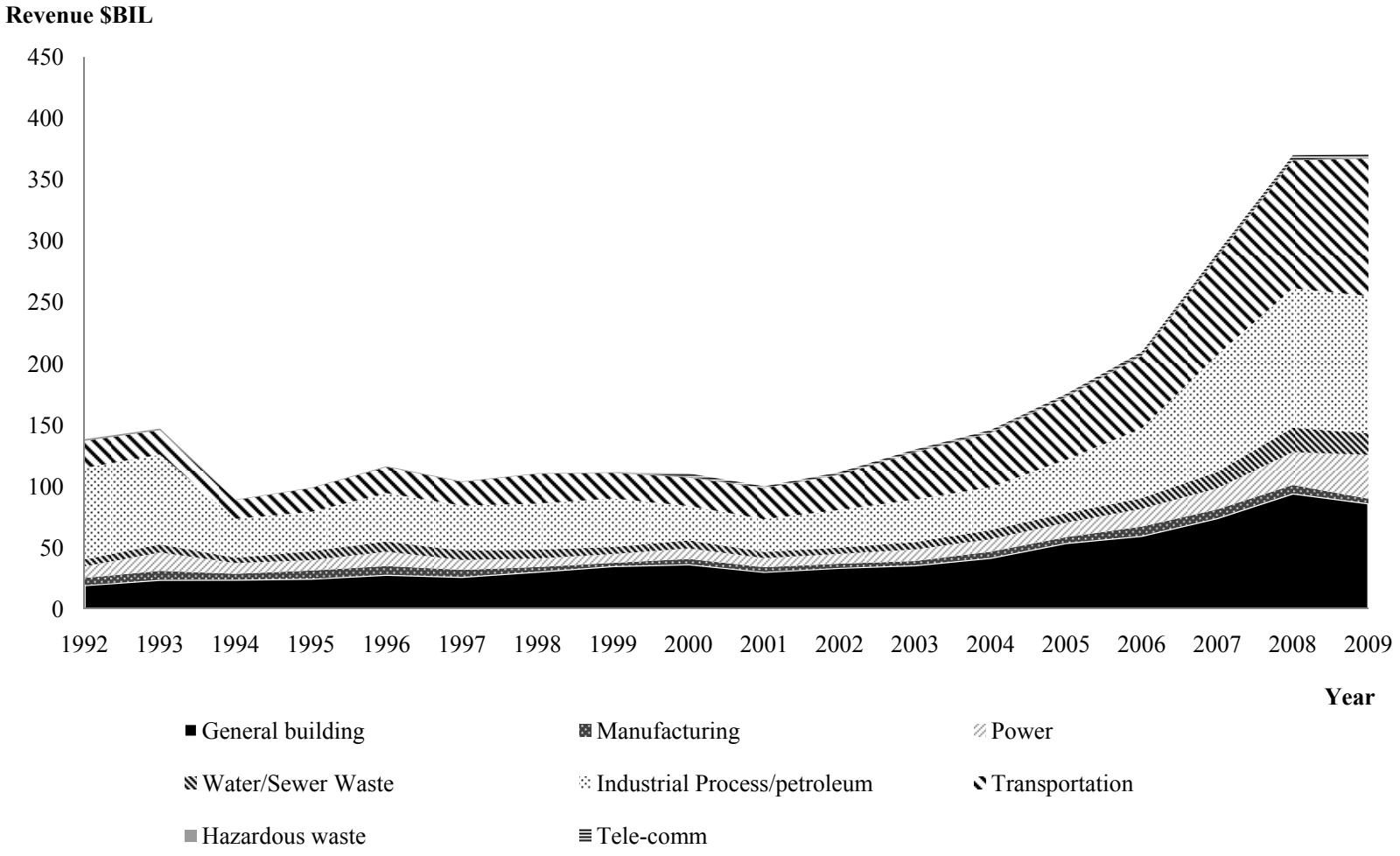

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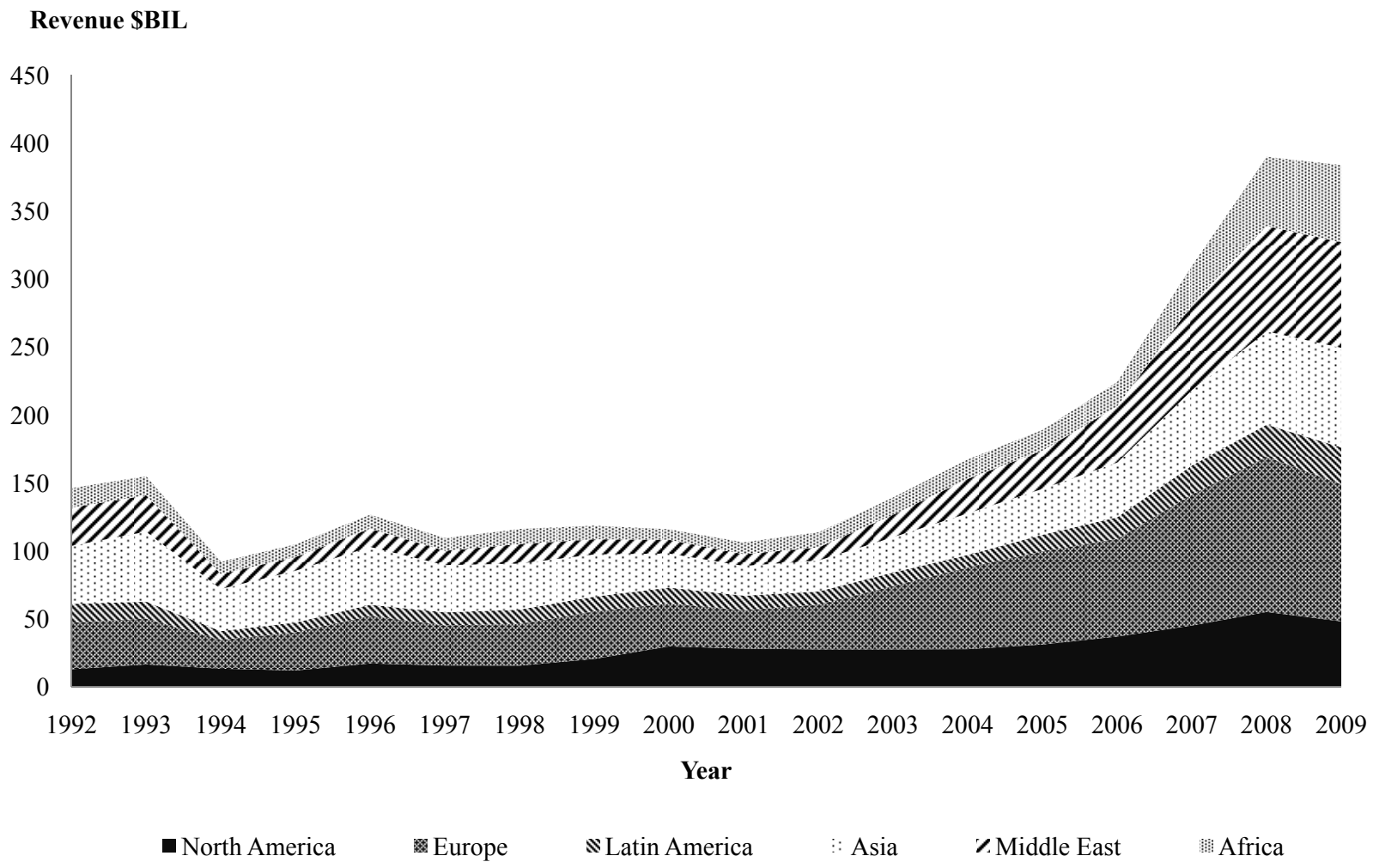

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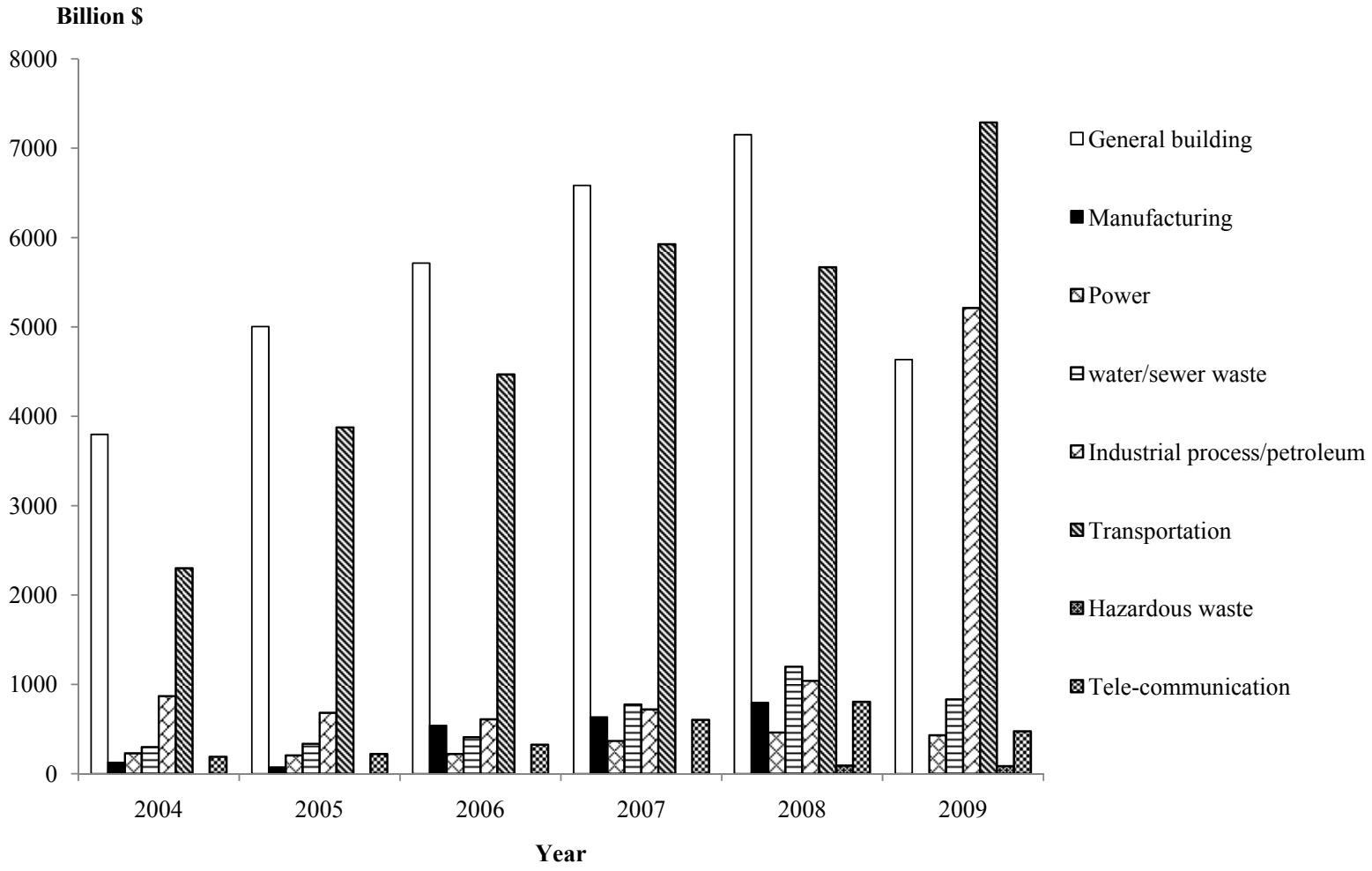

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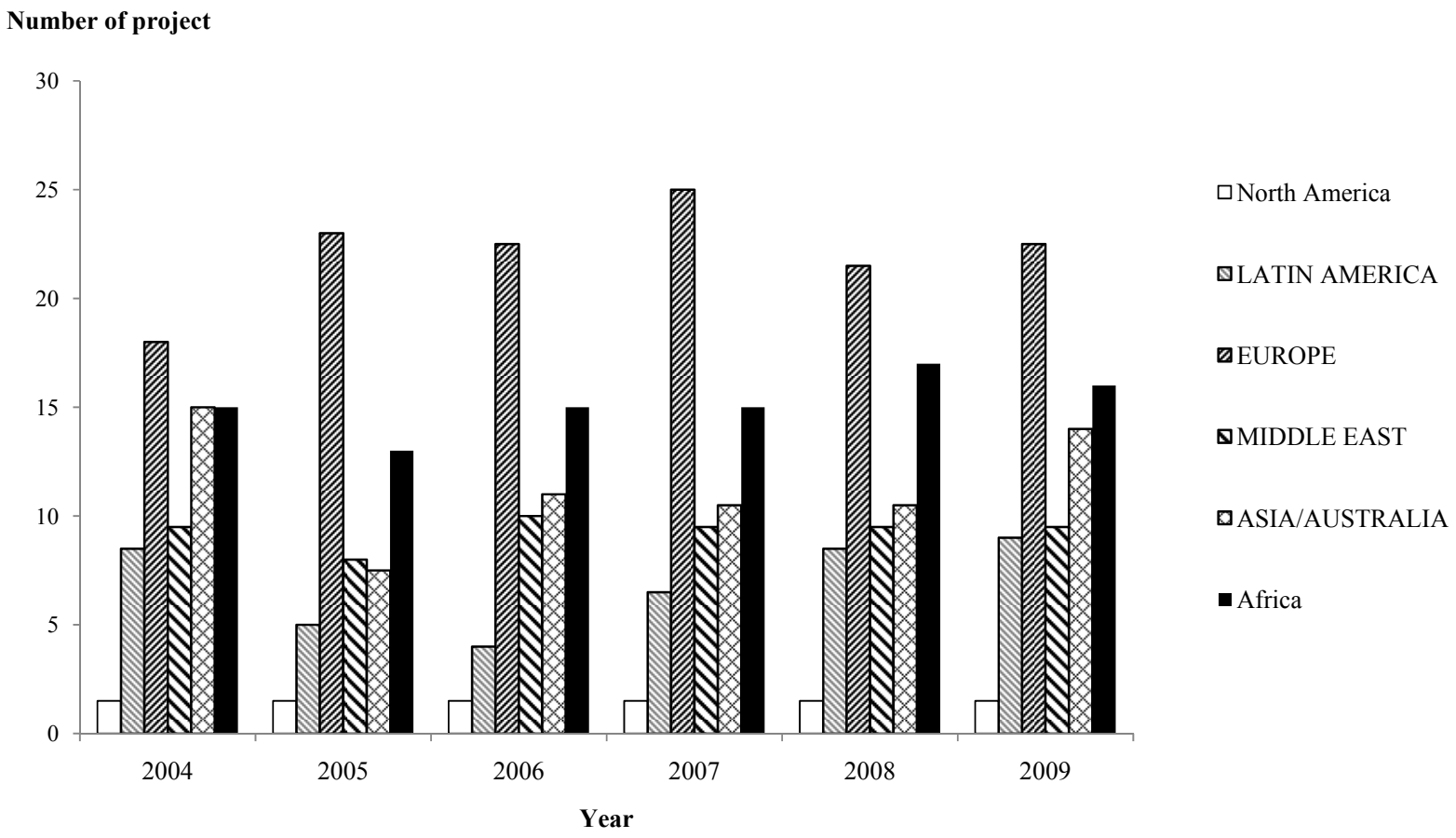

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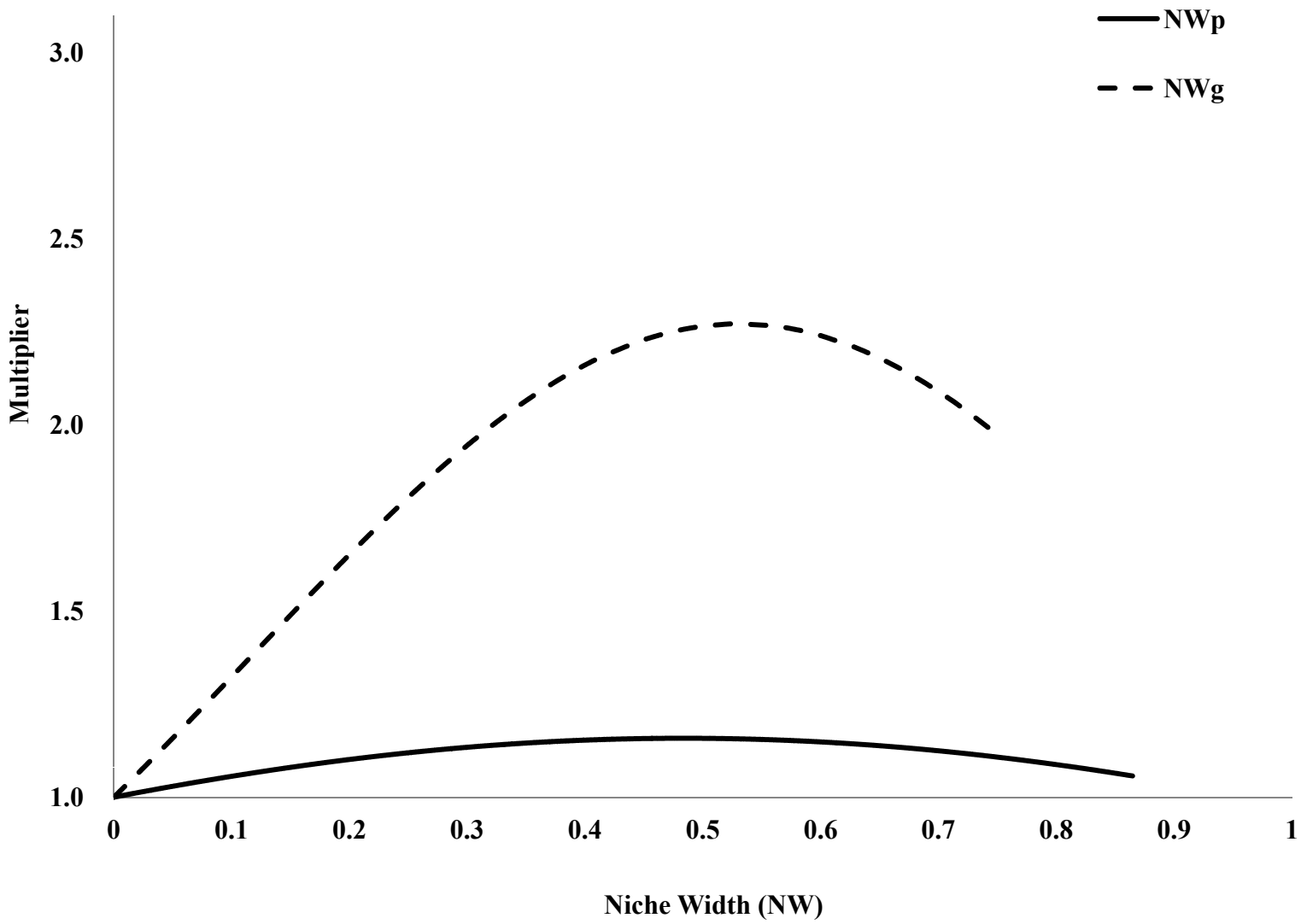

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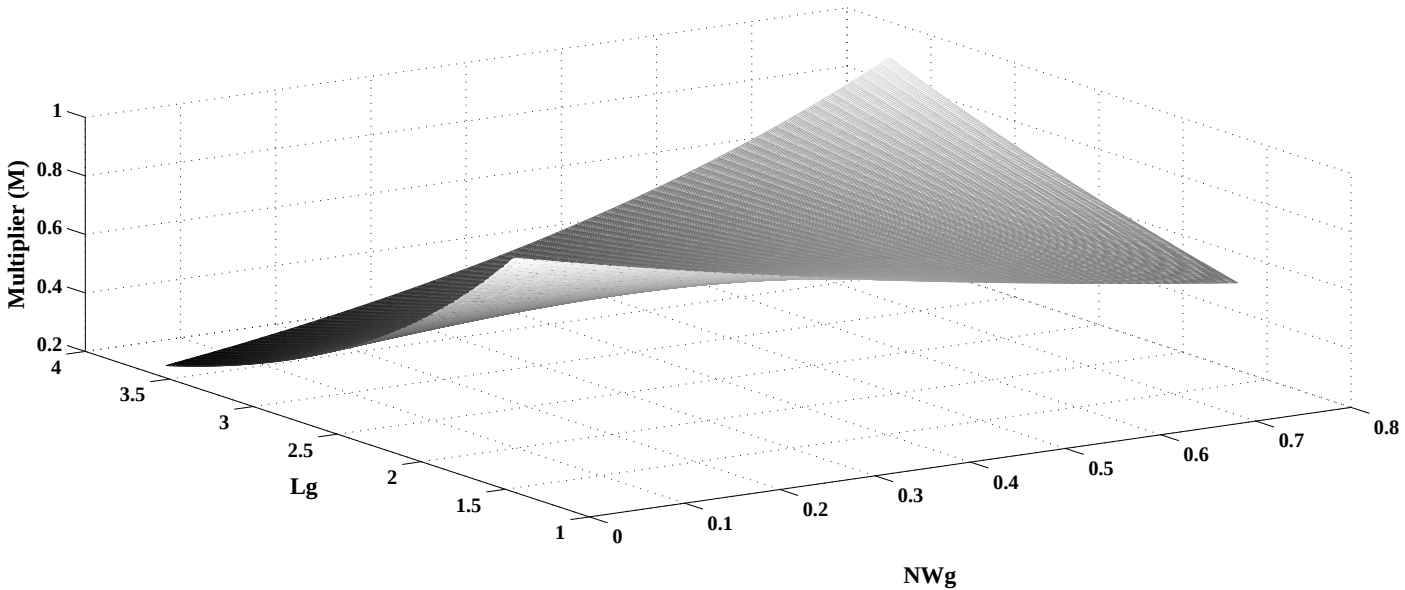

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