AN EXPLORATION OF THE RELATIONSHIP BETWEEN INTERNATIONAL DIVERSIFICATION AND FIRM PERFORMANCE IN CONSTRUCTION FIRMS

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Abstract

International diversification is a growth strategy that is being applied by more and more construction firms in order to capitalize on the increasingly globalized construction market. It is also an effective strategy to accommodate the ups and downs of home markets. Although the relationship between international diversification and firm performance has been extensively examined in international business literature, previous studies focus on manufacturing and general service sectors, the relationships behaviour is unknown in the construction sector. This gap is bridged by the analysis of more than 50 international contracting firms based in the US, Europe, and Japan. They were assessed in terms of their degree of international diversification, corporate operation performance and the correlations between the two variables. Control variables include home country and firm size. Whether their relationship is U-shaped, inverted-U-shaped or S-shaped (three stage) is explored. Theoretically, the findings provide a better understanding of the general relationship between international diversification and performance. Practically, they provide international contractors benchmarking information to evaluate or plan for their degree of international diversification.

Keywords: International Diversification; Firm Performance; International Construction; Globalization; Strategic Management.

Introduction

The international construction sector is an important part of the global economy. Through international projects, contractors can achieve opportunities for growth that may be unavailable in their domestic market. They may also capitalize on expertise and experience gained from long involvement in a type of construction or from the use of a new sophisticated technology (Ashley and Boner 1987). With regards to the contractors' country of origin (home country), the benefits of international construction can be grouped into six categories: 1) expatriation of profits from foreign projects; 2) export of equipment and material as a direct result of foreign project work; 3) export of services (such as insurance, transportation, and financing) as a direct result of foreign project work; 4) repatriation of personal income in the foreign projects; 5) follow-up procurement of home country goods and services resulting from the continued operation and maintenance of foreign projects; and 6) employment of home country nationals both in home and host countries (U.S. Department of Commerce 1984). It is therefore not surprising that global diversification as a growth strategy, to a more or less content, has been applied by many construction firms.

Despite the numerous benefits of international diversification, the optimum degree of diversification remains unknown in the international construction discipline. The annual surveys carried out by Engineering News Record (1996 through 2007) showed that on average international projects and local projects have similar profit margins (see Fig. 1). The correlation

coefficient of the two sets of data (domestic profit versus international profit) is 0.85, indicating a high correlation between them A one sided t-test gives a P-value of 0.211, further confirming that there is no big difference in profitability between domestic and international businesses. This implies that the favoured degree of international diversification (e.g, the more diversified, the better) is not that obvious but needs deeper analysis.

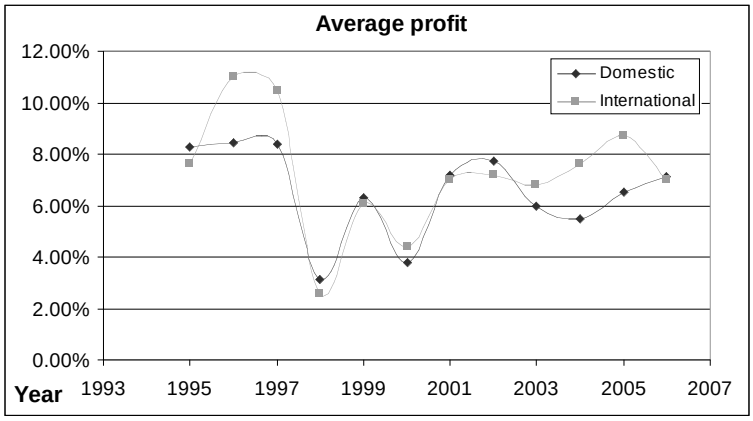

Fig. 1. Average profit (profit before tax over revenue): international market versus local market (Source: ENR 1996-2007)

In the manufacturing and general service sector, the relationship between international diversification and corporate operation performance has been widely examined (see Table 1).

Table 1. Previous literature on the relationship between firm performance and international diversification since 1990 (adapted from Contractor et al. 2003)

Relationship	Author(s) and year	Performance indicators	Sector
Linear (positive	Han et al. (1998)	ROE, asset turnover, profit margin	Manufacturing
or negative)	Jung (1991)	After-tax net income/total assets	Manufacturing
	Colins (1990)	Total risk, Debt to equity ratio, Beta	Manufacturing
	Morck and Yeung (1991)	Market value	Manufacturing
U-shaped	Qian (1997)	ROE	Manufacturing
	Ruigrok and Wagner (2002)	ROA	Manufacturing
Inverted-U-	Sullivan (1994a, b)	ROA, ROS	Manufacturing
shaped	Ramaswamy (1995)	ROA, ROS, ROVA	Manufacturing
	Gomes and Ramaswamy (1999)	Cost of sales/total sales, ROA	Manufacturing
	Hitt et al. (1994)	ROA, ROS	Manufacturing
	Capar and Kotabe (2003)	ROS	General service
S-shaped	Contractor et al. (2003)	ROS, ROA	General service

Note: ROE-Return on equity; ROA-Return on assets; ROS-Return on sales; ROVA-Return on value added.

These studies have revealed various types of relationship between international diversification and corporate performance: positive linear; negative linear; U shape; inverted U shape; and S shape (see Fig. 2).

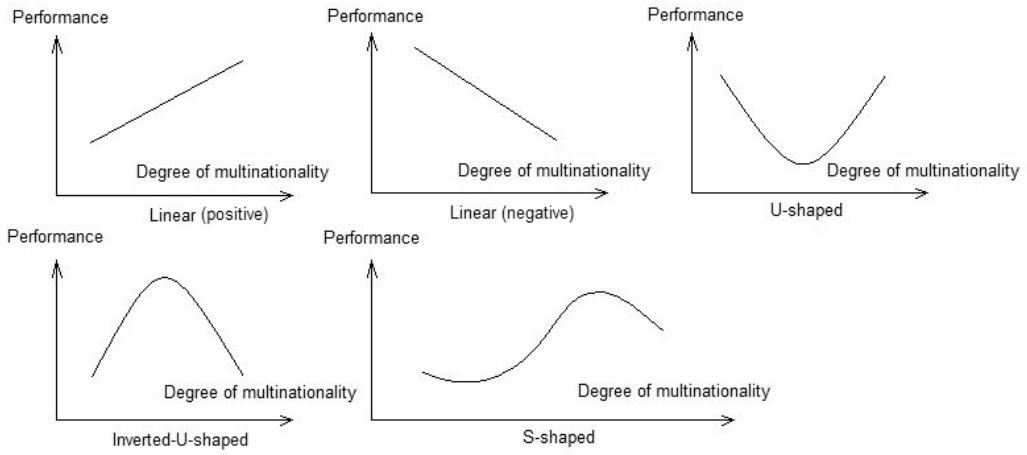

Fig. 2. Different types of relationship between firm performance and international diversification

The definitions of these relationships are given in Table 2.

Table 2. Different types of relationship between firm performance and international diversification

Relationship type	Definition
1. Negative linear relationship	Performance declines with internationalization.
2. Positive linear relationship	Performance improves with internationalization.
3. U-shaped relationship	Performance declines in initial internationalization, and then improves beyond a 'threshold' degree of internationalization.
4. Inverted-U-shaped relationship	Performance improves in initial internationalization, and then declines beyond a 'threshold' degree of internationalization.
5. S-shaped relationship	Performance declines in initial internationalization, improves after a 'threshold' degree of internationalization, and then declines again beyond a second 'threshold'.

The difference comes from the different populations targeted or the different methods used to measure variables. None of these studies were specifically directed at the construction sector and, as a matter of fact, most of them were surrounded the manufacturing sector.

Research methods:

Research question:

- The characteristics of the construction sector make the direct application of these findings impossible.
- It is therefore important to identify the relationship between international diversification and firm performance, specifically for construction firms.

Research Objectives:

- To identify the relationship between international diversification and corporate performance in construction firms by empirical analysis of data concerning diversification strategy and financial performance collected from leading international contractors around the world.

The reason for focusing on these leading international contractors is because the 'success reasons' about them has been recognized as one of the most critical issues for research by the industry and academia (GRNIC 2007).

The sample

The leading international contractors are identified on the ENR Top 225 international contractor ranking list for 2005 (reported in ENR 2006). However, because the study involves financial data that is of a sensitive nature, only those contractors listed in stock markets (i.e. those who have to report their financial performance and other related information to the public) are included in the investigation. Some "outliers" (those ranked occasionally high in the ENR survey, for undertaking mega projects) are screened out by referring to the ranking lists in other years (2003 and 2004). Table 3 lists the 52 sampled international contractors, all had an international revenue over 190 million US$ in 2005 and they, in total, account for about half of the top 100 international contractors in the ENR ranking list for 2005.

Table 3. Sampled contractors (52 international contractors; data source: ENR and various annual reports)

Contractor	Home country	Employee number	International revenue (US$	Total revenue (US$ M)
HOCHTIEF	Germany	41,469	14,733.3	17,014.7
Skanska	Sweden	53,806	11,904.3	14,983.9
STRABAG SE	Austria	44,513	8,719.0	10,989.0
KBR	USA	Unknown	7,722.6	8,831.5
Fluor	USA	34,836	7,124.9	10,785.1
Technip	France	20,898	6,375.0	6,680.0
Bilfinger Berger AG	Germany	55,346	5,815.0	8,790.0
Royal Bam Group	Netherlands	27,190	4,995.0	9,249.0
Ferrovial	Spain	57,247	4,667.5	10,786.8
JGC	Japan	4,147	2,961.0	3,541.0
Grupo ACS	Spain	113,273	2,486.6	14,290.7
Chiyoda Corp	Japan	2,431	2,256.0	2,846.0
Balfour Beatty	UK	27,592	2,202.0	8,988.0
Construtora Norberto Odel	Brazil	Unknown	2,016.0	2,705.0
Kajima Corp	Japan	9,460	1,882.3	13,343.5
Aker Kvaerner	Norway	18,324	1,761.1	2,563.0
EIFFAGE	France	50,500	1,690.0	9,973.0
Snamprogetti	Italy	23,355	1,615.0	2,615.0
Obayashi	Japan	9,646	1,551.0	12,152.0
Jacobs	USA	27,200	1,468.0	3,125.9
Taisei	Japan	9,249	1,360.0	13,138.0
Foster Wheeller	USA	Unknown	1,316.0	1,443.0
Takenaka	Japan	Unknown	1,212.0	10,012.0
Impregilo S.p.A.	Italy	10,138	1,145.0	2,881.0
Shimizu Corp	Japan	9,019	1,047.2	11,509.0
CB&I	USA	9,991	1,042.0	2,258.0
Toyo Engineering	Japan	5,300	1,008.0	1,289.0
ACCIONA S.A.	Spain	Unknown	885.0	5,748.0
FCC	Spain	67,562	872.4	8,799.0
Enka construction	Turkey	Unknown	814.0	894.8
Leighton	Australia	21,270	805.0	5,776.0
BESIX	Belgium	Unknown	797.0	1,219.7
URS	USA	29,200	706.2	2,848.8
Hyundai	Korea South	Unknown	636.4	4,159.2
Veidekke	Norway	5,598	635.2	1,825.1
Astaldi SPA	Italy	5,938	615.5	1,143.0
Nishimatsu Construction	Japan	4,002	561.6	3,599.5
Tecnicas Reunidas SA	Spain	2,644	510.0	856.0
E. Pihl & Son	Denmark	2,359	354.4	674.2
Bauer AG	Germany	5,155	345.7	608.7
Penta Ocean	Japan	3,684	339.4	2,666.3
Rizzani de eccher spa	Italy	957	336.5	456.4
Ghella Spa	Italy	2,119	320.7	439.9
Construtora Andrade Gutie	Brazil	4,070	288.8	760.4
Worley Parsons	Australia	12,000	287.3	301.8
Soares da Costa, SGPS-	Portugal	Unknown	274.3	612.2
Kinden Corp	Japan	6,428	272.0	3,725.0
Hazama	Japan	2,002	233.0	1,741.0
CMC Ravenna	Italy	5,058	225.5	629.9
Kumagai Gumi	Japan	2,681	221.0	2,329.0
CTCI Corp	Taiwan	Unknown	215.8	761.1
Shaw Group	USA	Unknown	193.7	2,348.2
Mean		20,675	2188.9	5225.1
S.D.		23,673	3065.7	4738.2
Min		957	193.7	301.8
Max		113,273	14733.3	17014.7

Variables and measures

Performance
There are multiple variables that can be used to measure a firm's operation performance such as ROE, ROS and ROA. This study chooses ROS because assets of construction firms usually do not cover the intangible assets such as reputation which play an important role in acquiring jobs. Returns before tax is used because home countries usually have different tax systems. It is also noted that net income on revenue is only suitable for internal comparison and cannot be used in such a cross company analysis.

International diversification
To measure the degree of international diversification in the international construction domain, different measures were suggested (Low and Jiang 2004). For the same reason as above, asset related measures are rejected. The location related index is also rejected because it only measures the scale of overseas expansion via 'permanent entry', while project/contract based business carried out by head office is also significant nowadays (Chen 2005). In recent years, ENR has ceased reporting geographic scope information, as a result it is not used in this study. Similar to studies in international business, the ratio of international revenue over global revenue is used to measure the degree of international diversification in this study.

Control variables
Unlike most other service industries, the construction industry is capital–intensive. In international projects, contractors are often required to make down payments, take project equity or help in acquiring project financing. This makes firm size an important condition for construction firms to enter the worldwide market. Firm size is therefore included as a control variable to control for economies and diseconomies of scale at the corporate level. Firm size can be measured in multiple ways, e.g., employee number, quantity of assets or total revenue. For the same reason as above, quantity of assets is not a good measure. Also, various procurement methods such as subcontracting and project management make employee number a weak measure of firm scale. Therefore, total revenue (including both international and domestic revenue) is used in this research to measure firm size. Log transformation is undertaken to make the distribution of data closer to normality (*semi-elasticity*).

Home countries are controlled for host country related issues, if any. The sampled contractors can be grouped into four categories: 1) USA contractors; 2) European contractors; 3) Japanese contractors; and 4) other contractors (including Korean, Brazilian, Turkish, etc.). Among them, *other contractors* is the dummy variable.

Since the data was collected for 2005 and 2006, to control for the difference between the two years, a binary variable Y06 (year 2006) is included. Therefore, year 2005 is the dummy variable.

Data collection

The financial performance information of the sampled contractors was collected from their consolidated income statements as part of the annual reports for 2005 and 2006. The international and total revenue of these contractors was obtained from ENR (2006 and 2007). It is important to note some of the limitations of the ENR data: 1) much of the ENR data is obtained by annual self-reporting surveys completed by participating firms. Definitional problems and the self-interests of firms to appear in the best possible light may, in some cases, convey misleading information relating to individual firm rankings (U.S. Department of Commerce 1984); 2) ENR consolidates subsidiary data with data of the subsidiary's parent company, even though the subsidiary may dominate the business of the parent company and be located in a country other than that of the parent company (U.S. Department of Commerce 1984); and 3)ENR systematically overstates the aggregate volume of construction activity by double-counting the subcontracts already accounted for by main contracts awarded to other large firms (Linder 1994).

Even though these problems exist, the ENR data on international construction is the best of its kind available, it is useful for capturing trends over time and relative distributions among firms and countries (Linder 1994; U.S. Department of Commerce 1984).

Model specifications

A pooled two-period panel data regression analysis was carried out to explore the relationship between international diversification and corporate performance in construction firms with the model specifications as below:

$$Perf = \beta_0 + \beta_1 SIZE + \beta_2 Y06 + \beta_3 C1 + \beta_4 C2 + \beta_5 C3 + \beta_6 ID + e \quad (1)$$
$$Perf = \beta_0 + \beta_1 SIZE + \beta_2 Y06 + \beta_3 C1 + \beta_4 C2 + \beta_5 C3 + \beta_6 ID + \beta_7 ID^2 + e \quad (2)$$
$$Perf = \beta_0 + \beta_1 SIZE + \beta_2 Y06 + \beta_3 C1 + \beta_4 C2 + \beta_5 C3 + \beta_6 ID + \beta_7 ID^2 + \beta_8 ID^3 + e \quad (3)$$

Where, Perf is corporate performance; SIZE the firm size; Y06 year 2006, C1 American contractors, C2 European contractors; C3 Japanese contractors; ID the intentional diversification; ID^2 a squared term of ID; ID^3 a cubic term of ID; and e the error term. As can be seen, Equation 1 represents the linear model, Equation 2 represents the U shaped model; and Equation 3 represents the S shaped model.

Results and discussion

Table 4 reports the mean, standard deviation, minimum and maximum values of the interval variables involved in the study. The correlation coefficients of these variables are also reported. They are very small, indicating that multi-collinearity should not be a big issue.

Table 4. Means, standard deviations and correlations (N=104)

	Mean	*S.D.*	*Min*	*Max*	*SIZE*	*ID*	*ROS*
Firm size (SIZE)	5930.955	541.620	232.400	24960.000	1		
Diversification (ID)	0.480	0.029	0.040	1.000	-0.192	1	
Firm performance (ROS)	0.053	0.004	-0.068	0.227	-0.162	0.207	1

Table 5 presents the results of the regression analyses regarding the three specifications. Financial performance of international contractors is determined by many factors, so low adjusted R^2s were expected. All three models are statistically significant at the $P<0.01$ level. However, Model II (U-shaped), an examination of the U shaped effect of international diversification on ROS, has the largest adjusted R square (20.4%). The results show that there is a U Shaped relationship between international diversification and corporate performance in leading international construction firms.

Table 5: Effect of international diversification on firm performance

ROS vs:	Model I (Linear)	Model II (U-shaped)	Model III (S-shaped)
Intercept	0.098 ***	0.150 ***	0.157 ***
Size (SIZE): log of total revenue	-0.008	-0.013	-0.014
Year 2006 (Y06)	0.006	0.005	0.005
C1: USA	-0.012	-0.005	-0.006
C2: Europe	-0.029 **	-0.017	-0.018
C3: Japan	-0.044 ***	-0.048 ***	-0.050 ***
International diversification (ID)	0.016	-0.202 ***	-0.256
Intl.div. ^{2}(ID^2)		0.207 ***	0.326
Intl.div. ^{3}(ID^3)			-0.074
Adjusted R ^{2}	12.1%	20.4%	19.6%
F-value	3.366 ***	4.761 ***	4.137 ***
Number of observations, N	104	104	104

Note: * P<0.10; ** P<0.05; *** P<0.01.

Model I, the examination of linear relationship and Model III, the examination of S-shaped relationship, have a smaller adjusted R square. Although in Model I the efficient of ID is not significant, its sign is positive, indicating there is a modest positive relationship between international diversification and corporate performance. As can be seen in Model III with the involvement of term ID^3, the adjusted R square becomes less than that of ModelII. Also, none of the coefficients of ID, ID^2 and ID^3 are significant, even at the P<0.1 level. This shows that there is no support for an S-shaped relationship between international diversification and corporate performance in international construction firms.

In Model II, the coefficients of ID and ID^2 are both significant at the P<0.01 level. The coefficient of ID has a negative sign and that of ID^2 has a positive sign, indicating a U-shaped relationship.

Assuming away the effect of SIZE, home country and time difference, the estimated regression equation for the U shaped model becomes:

$$ROS = 0.15 - 0.202ID + 0.207ID^2$$

A partial derivative of the curvilinear regression equation is taken with respect of ID:

$$\frac{\partial(ROS)}{\partial(ID)} = -0.202 + 0.414ID$$

Which will be 0, if ID = 0.487. This partial derivative will be negative if ID<0.487; it will become positive if ID>0.487 (see Fig. 3).

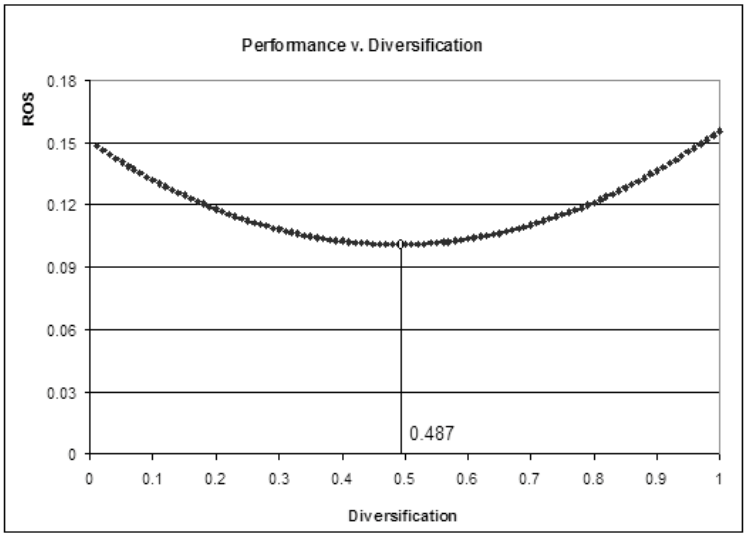

Fig. 3. Fitted curve of firm performance (ROS) versus international diversification (ID)

The implication is that the incremental effect of international diversification on firm performance will remain negative until the degree of international diversification reaches 48.7%. Above and beyond this threshold value, international diversification is expected to improve corporate performance.

A two sample t-test is also carried out to compare the performance of international contractors who have an international diversification over 48.7% with those below 48.7%(see Table 6). The results show that at the P<0.10 level, contractors who are more internationally diversified (over 48.7%) enjoy a better financial performance.

Table 6. The mean difference in ROS between low and high-international diversification groups (t-test)

Group	N	Mean	S.D.	T-Value
ID>48.67%	51	0.060	0.052	1.495 (P=0.069)*
ID<48.67%	53	0.047	0.032	

Note: * P<0.10.

The results of regression analysis and t-test imply that it is not easy to make the best of international diversification. Going international requires a large minimum overhead burden, which, if spread over a small portfolio of projects, dilutes the overall operating margin. Therefore international contractors should try to achieve economy of scale in global expansion to make the best of the global construction market.

The result confirms the study of Contractor et al. (2003) who reported the existence of a three stage S-shaped relationship for knowledge based sub-sector firms, but there is a U-shaped relationship for capital-intensive companies (including those from the construction industry). The result also confirms the study by Caper and Kotabe (2003) who reported a U-shaped relationship based on a sample of German service companies. However, the threshold values of the U shaped relationship are different between the three studies, further confirming the necessity to treat the international contractors as a special group.

It is interesting to see that the coefficients of C3 are significant and negative in sign in all three models, indicating that, in comparison with other contractors, Japanese contractors are weak in reaping the benefits of international transactions. This reflects the fact that Japanese contractors traditionally focus on their domestic market.

Discussion and Conclusions

It was found that there is a U shaped relationship between international diversification and corporate performance for leading international contractors, which is consistent with previous studies regarding the general service sector, and that 48.7% is a threshold value that differentiates the various effects of international diversification on corporate performance. The findings further confirm the necessity to treat the construction sector as a special area and remind of a careful application of research results from general international business studies, which usually focus on the production and general service sector, to the construction sector. The managerial implication of this study is that, in general, at the initial stage of internationalization or at a low level international diversification, the benefits of contractors' global expansion is restricted by the diseconomies of scale associated with such expansion, but will materialize when beyond a certain degree of diversification. In this sense, large international contractors should try to grow as globally as possible.

The study also has a number of limitations. Most of the sampled contractors come from developed countries and have a large overseas portfolio. The results may not apply to firms who have a small international portfolio. The companies, whose international business is more project based and who are more selective in project pursuits (in adjacent countries and on more profitable projects), may have the threshold point different from (and possibly lower than) 48.7%. However, if a large international portfolio is targeted (e.g., more than 200 million US dollars per year), the incremental effect of international diversification cannot be neglected.

Studies on the performance, structure, and strategies of leading international contractors are still very limited in the construction management area. It is apparent that these topics are becoming more and more important with the increasing globalization of the construction market and industry. It is hoped that the current paper was a step in this direction.

Key Lessons Learned:

- There is a U shaped relationship between international diversification and corporate performance for leading international contractors.
- 48.7% is the threshold value of international diversification that differentiates the different effects of international diversification on corporate performance.

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