

Application of Real Option Analysis for Valuing the Japanese Construction Firms in the International Market

by

Takemasa Soma

B.Eng. Civil Engineering (1996)
Kyoto University

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Signature of Author _____
Department of Civil and Environmental Engineering
May 9th, 2003

Certified by _____
Fred Moavenzadeh
James Mason Crafts Professor of Engineering Systems
Department of Civil and Environmental Engineering
Thesis Supervisor

Accepted by _____
Oral Buyukozturk
Chairman, Departmental Committee on Graduate Studies

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Abstract

The Japanese construction firms have been able to keep their sales and shares in the market for many years at the initiative of the government. Recently however, the Japanese economy has been in recession, and public as well as private construction investments have been progressively shrinking according to it. In such a market situation, the Japanese construction firms should improve their productivity or growth rate to manage their firms and keep their assets such as employees. For productivity, firms should make a strong effort to development of human resources, R&D, M&A, and so on. On the other hand, in terms of their growth rate, they should expand their market shares in the Japanese market or enter into a new market including the international market.

The research first gives an overview of the current situation of the Japanese construction market and explains the importance of a firm's productivity and growth rate to cope with the shrinking market. Then the research analyzes risks in the international market mainly focusing on volatility of order amounts, currency, interest rates, and political risks. Next, the research examines valuation of a firm using two approaches of Discounted Cash Flow method (or DCF) and Real Option Analysis (or ROA). Basically, DCF can be applied to certainty projects in the Japanese market and ROA can be applied to uncertainty projects in the international market because of a lot of volatilities related to risks in the market. Finally, this research examines strategies for maximizing a firm's value using ROA because ROA help managers understand and quantify a portfolio value of each project.

Thesis Supervisor: Fred Moavenzadeh

Title: James Mason Crafts Professor of Engineering Systems
Department of Civil and Environmental Engineering

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Brookline, Massachusetts
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CHAPTER I

INTRODUCTION

1.1 Objectives of This Research

The Japanese construction firms have been protected by the government for more than 100 years to keep their sales and huge employees, and they have not needed to expand their shares in the domestic or overseas market. This means that there is no competitive situation in the Japanese construction market. Indeed, the share of the firms in the domestic market has been constant for many years and the share of international sales has been only 5% of their total sales for the last 15 years. They have not needed to expand their market overseas. When the economy in Japan had been growing, supply in the domestic market had been enough for them to manage their fixed assets like employees. Because both public and private construction investments are now shrinking due to the recession, however, the firms should take some strategies for it.

As a strategy for the market situation, they need to expand their market shares not only in Japan but also overseas. Moreover, the Japanese construction market is applied to the international standards including international accounts, Private Finance Initiatives (or PFI), and so on. To cope with the trends such as the shrinking competitive market and internationalization, the Japanese firms should expand their market overseas and apply to the international standards.

Because a lot of firms have not applied to the trends, they cannot help dumping their bid prices to keep their sales and market shares. However, they eventually worsen their financial environment and some firms go into bankrupt because they do not consider optimal strategies to expand their market or improve their performance in construction processes.

This research focuses mainly on the optimal strategies to expand their sales and improve their performance using two valuation methods of Discounted Cash Flow (or DCF) method and Real Option Analysis (or ROA). DCF method gives managers a way to analyze a value of projects with certainty in the Japanese market. In other words, DCF can be applied to a project when risks of the projects can be realized in advance from past data and other information. On the other hand, ROA can analyze a value of projects with uncertainty in a new market like the international market. ROA gives managers flexibility for their decision-makings because they can make their decisions according to a market situation. ROA is also useful for maximizing a value of a firm. ROA can quantify a portfolio value of each project as a whole firm's value by evaluating interactions of each project, although DCF can evaluate a firm's value by just adding values of each project.

To sum up, objectives of this research is first to analyze the current situation of the Japanese market and overseas market, and to show the necessities of expanding market and improving their performance. Next, this research gives a framework to calculate a project's and firm's values using both DCF method and ROA. Finally, it gives an adequate strategy to maximize a firm's value using ROA, considering risks in the international market.

1.2 Organization of This Research

This research is organized into five main Chapters from II to VI in addition to introduction (Chapter I) and conclusion (Chapter VII).

Chapter II introduces the current situation of the Japanese construction market. Section 2.1 shows that the Japanese construction market is shrinking since the collapse of the bubble economy and also shows the trends of public and private sectors' construction investment. Section 2.2 indicates the productivity of the Japanese construction market using financial indexes of ROIC and growth rate. Section 2.3 shows unique characteristics of the market including business customs and organizations. This section also explains market analysis using Michael Porter's model. In addition to external situations of the Japanese construction firms, Section 2.4 introduces internal investments of the Japanese construction firms including R&D and development of human resources.

Chapter III analyzes the international construction market. Section 3.2 shows total contract amounts of the Japanese construction firms in the market, and analyzes them by regions and ownerships. Then, Section 3.3 analyzes risks related to the international construction market. Risks are analyzed into two parts of expected risks and unexpected risks. Expected risks are mainly economic risks, such as order amounts, currency, and interest rate, which can be analyzed in advance from economic information. On the other hand, unexpected risks are problems in contracts such as design changes and changes in natural conditions, which cannot be analyzed in advance.

Chapter IV explains DCF method according to a valuation framework. Section 4.2 introduces a framework to analyze historical performances of a firm such as ROIC and growth rate using financial statements. Then Section 4.3 shows a calculation method for WACC considering their optimal capital structures. After analyzing the historical performances, Section 4.4 and 4.5 explain a method to forecast future cash flows and

continuing values assuming a few market scenarios. EVA or EP is a useful index of evaluating a firm's historical performance and then forecasting future cash flows. Section 4.6 finally explains that valuation of a firm can be evaluated by simply adding each NPV for each project. DCF is useful for certainty projects like in the Japanese market.

Chapter V also explains ROA after explaining disadvantages of DCF. Section 5.2 analyzes risks, which can be evaluated using ROA. Then Section 5.3 introduces real options. Real option for the international construction market is mainly separated into three categories; option to defer, option to alter operating scale, and growth option. In addition to these options, Section 5.4 introduces evaluation of competition in which competition is analyzed into two categories; expected competition and unexpected competition. Because of low entry barrier of the international market, competition is important in the market.

Chapter VI summarizes the DCF method and ROA, and examine a strategy to maximize a firm's value. Section 6.2 shows useful ways of real options including synergy effect and interdependences of each project to calculate a portfolio value of the firm. Section 6.3 introduces a strategy to maximize a firm's value according to five steps; planning and goal, qualification, control objectives, choice and management, and improvement. Managers should continuously revise and improve their strategy according to market changes.

The structure of this research is shown in Figure 1-1.

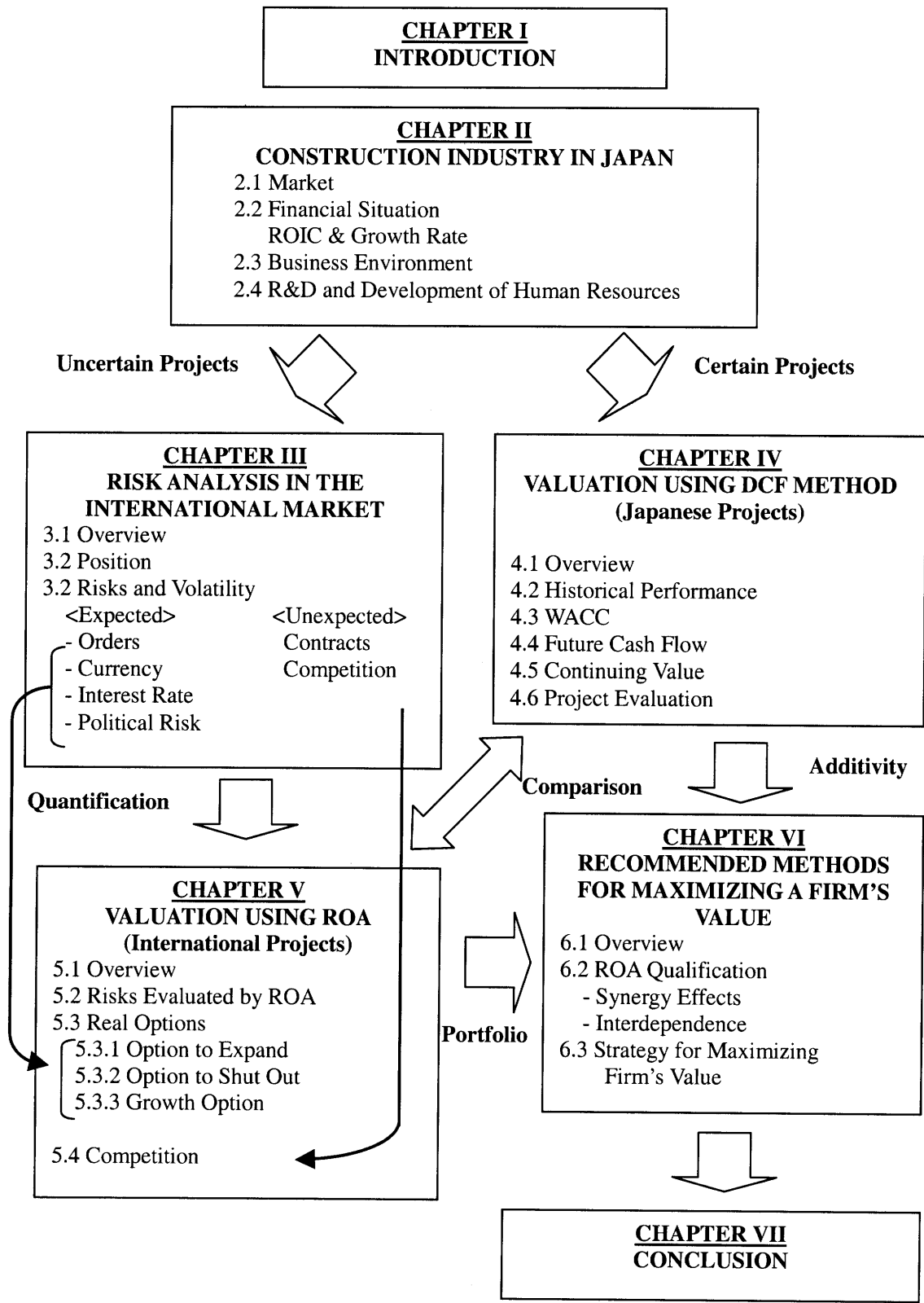


Figure 1-1 Thesis Structure

CHAPTER II

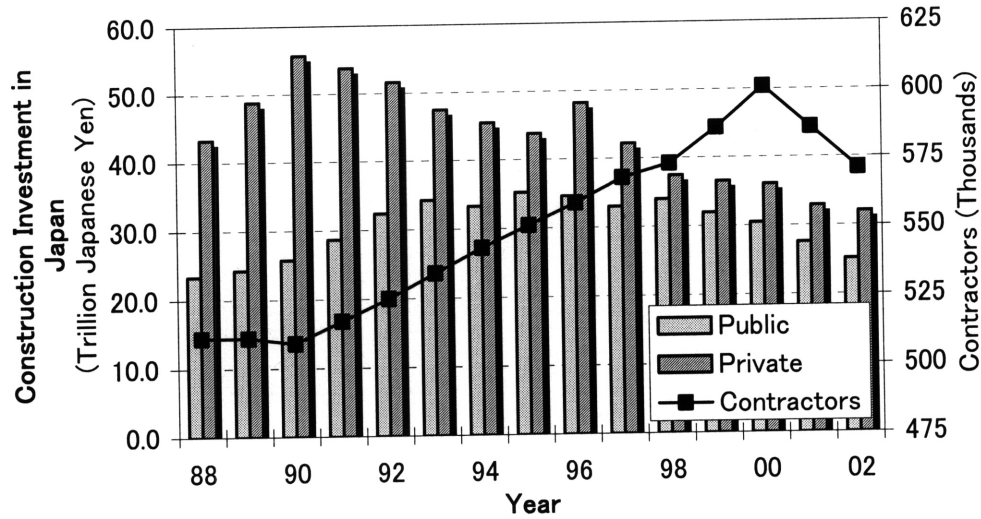
CONSTRUCTION INDUSTRY IN JAPAN

2.1 Market

The Japanese construction industry has been growing as the Japanese economy does for over a few decades. After the collapse of the bubble economy, however, investments have been drastically shrinking. For example, construction investments in Japan in the fiscal year 2000 are counted as 66.5 trillion Japanese Yen (or JPY), which is about 13% of Gross Domestic Product (or GDP) 513 trillion JPY, and construction laborers are also counted as 63.0 billion which is about 10% of all Japanese labor forces. It can be said that the construction industry is the largest in terms of those investments and labor forces. Moreover, the percentages are close to those in developing or emerging countries in East-South Asia and twice as much as those in developed countries like the United States.

Figure 2-1 shows both construction investments from 1988 to 2002 and its breakdown for those in 2000. During the bubble economy from the late 80's to early 90's, the investment had been increasing, however it has been rapidly decreasing for the last decade and currently become 70% of the total investments from both public and private sectors in 1990. This tendency comes from the fact that, in the recession, the public investment is gradually decreasing and private firms need to reduce investing to their fixed assets. In other words, because the volatility of investing assets is closely related to economic conditions, construction industry is one of the most vulnerable to the sluggish economy.

(a) Contract Investment from 1988 to 2002



(b) Breakdown for Construction Investment in Japan (2000)

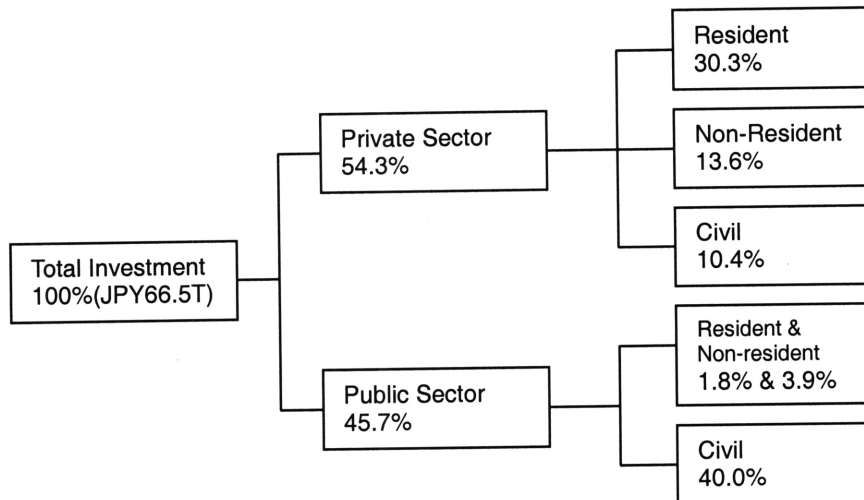


Figure 2-1 Analysis of Construction Investment in Japan
(Source: Ministry of Land, Infrastructure and Transport)

In addition to this tendency, there is a few years time lag between the collapse of the bubble economy and the starting point of decreasing investment from public sectors. This stems from the fact that it took a few years to finish large-scale projects constructed in the bubble economy, and that the government continued to invest to stimulate the economy even though investment from private sectors were dropping as soon as the bubble economy was collapsed. Due to the investment from public sectors, a lot of contractors

and labors flowed into the construction industry because its entry barrier of small-scale contractors is relatively low comparing to large-scale construction firms. Indeed, the government's decision of stimulating the industry gives an impact only on small-scale subcontractors. The large-scale construction firms still suffer from their fixed assets like a large number of employees and their huge debt, and they are not able to cope with it immediately because of the Japanese business customs such as lifetime employment system and mutual stock exchanges.

Although the large-scale construction firms are currently replacing the lifelong employees to temporary ones by restructuring their organization, they still financially suffer from the large number of employees. Moreover, a lot of construction firms also suffer from interests for their debts because they have engaged in development projects like real estates and golf courses, for example. In such a situation, the Japanese construction industry is in a critical situation and many firms that own many real estates have gone into bankrupt. These facts lead to decrease the number of contractors from the year of 2000 as also shown in Figure 2-1.

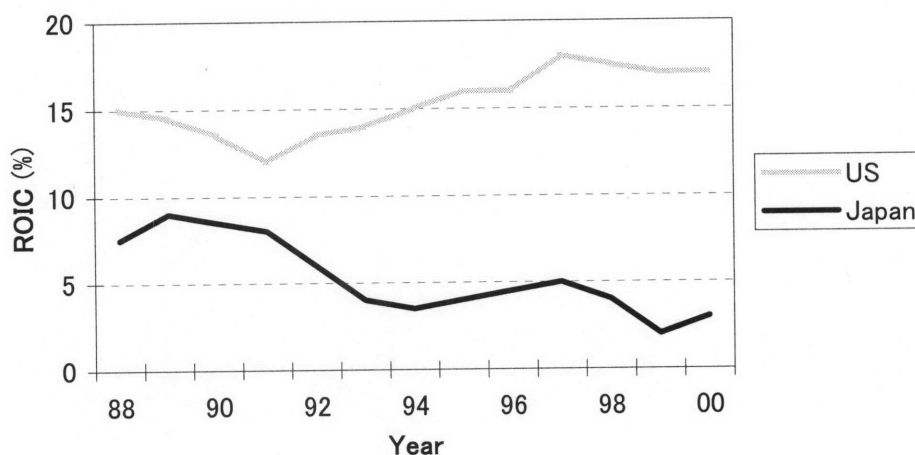
In addition to the fact that the construction industry is vulnerable to the economy, it might as well say that the Japanese construction industry is vulnerable to free competitive market. The first reason is that the government investment makes up more than 45% of total sales, and construction firms have run a business depending on it. That is, the industry has been developed at the initiative of the government. The second reason is that there are unique business customs in Japan. Japanese clients think that long time relations with contractors are more important than others such as price and quality, so once a client chooses a contractor, it does not change contractors so frequently for the next jobs. Because of the reasons, there was not a competitive situation in the Japanese construction industry. However, in the trend of shrinking market, competition has become inevitable and the construction firms are required to improve their competitiveness in their market.

2.2 Financial Situation

As mentioned in 2.1, the Japanese construction industry is expected to be shrinking and each firm should improve its competitiveness. In such a situation, large-scale firms should take two strategies to survive. The first one is to improve their productivity and the other is to increase their sales by expanding its market share in the existing market or by entering into a new market.

Productivity can be financially analyzed using Return on Invested Capital (or ROIC), which provides an indication of capital productivity without considering a firm's capital budgeting or capital structures. Increase in sales can also be analyzed using growth rate of sales and profits, which comes from increasing market shares in the existing market like Japan or from entering into a new market including the international markets.

Figure 2-2 shows that ROIC of the Japanese firms has been much smaller than that of the US firms for the last decades. Many analysts say that the difference has led to the Japanese recession. The Japanese construction firms should first improve their financial productivity considering ROIC.



*Figure 2-2 ROIC between Japan and US
(Source: Mckinsey & Co)*

Table 2-1 shows the average growth rates of sales and profits for large-scale construction firms in Japan. Because of the recent recession, the growth rates are now at low levels and they should consider a strategy to cope with it. One strategy is to expand their market share in Japan and the other is to expand their market overseas. Considering the current Japanese economy and internationalization in the Japanese construction market, the latter is considered to be better for future opportunities.

*Table 2-1 Financial Analysis for General Contractors
(From 1995 to 2001)*

Top 4 Firms	Sales In 1995 (USD)	Sales In 2001 (USD)	Growth Rate Sales (%)	Debt /Equity Ratio in 1999
Kajima	17765	12171	-5.2	12.8
Taisei	16742	11279	-5.4	11.3
Shimizu	17914	9893	-7.5	8.1
Obayashi	16083	9972	-6.3	5.3

(Source: Engineering News Record)

In addition to ROIC and growth rates, they should improve their capital structure. Because a lot of companies are suffering from development projects and investments in real estates conducted in the bubble economy, Debt to Equity ratios have become high and above 5.0. This leads to increase Weighed Average Cost of Capital (or WACC), which is examined in Section IV, and to reduce firm's values. In a finance theory, to improve a value of a firm is led by improving shareholder's value. That is, ROIC should exceed WACC while growth rate of a firm should be positive. In the case of Japan, although construction industry has been supported by high growth rate until the collapse of the bubble economy, it is inevitable from now to improve their capital performances like ROIC, WACC, and Debt to Equity ratio, keeping their growth rate positive even in the shrinking market.

2.3 Business Environment in Japan

The unique business environment in Japan makes construction firm's internationalization difficult. This section first focuses on the Japanese business customs and structures, and then analyzes the difference of business environments between the Japanese and the international market.

2.3.1 Business Customs and Structures

The Japanese construction market is said to be in methodical fashion and the structure is layered with many tiers as shown in Figure 2-3. In this structure, there can be seen two unique characters in contracts. One is that there is a tendency that contracts are vague according to lower layers. The other is that traditional and confidential relationships are more important than contract documents between client and general contractors, and between general contractors and subcontractors.

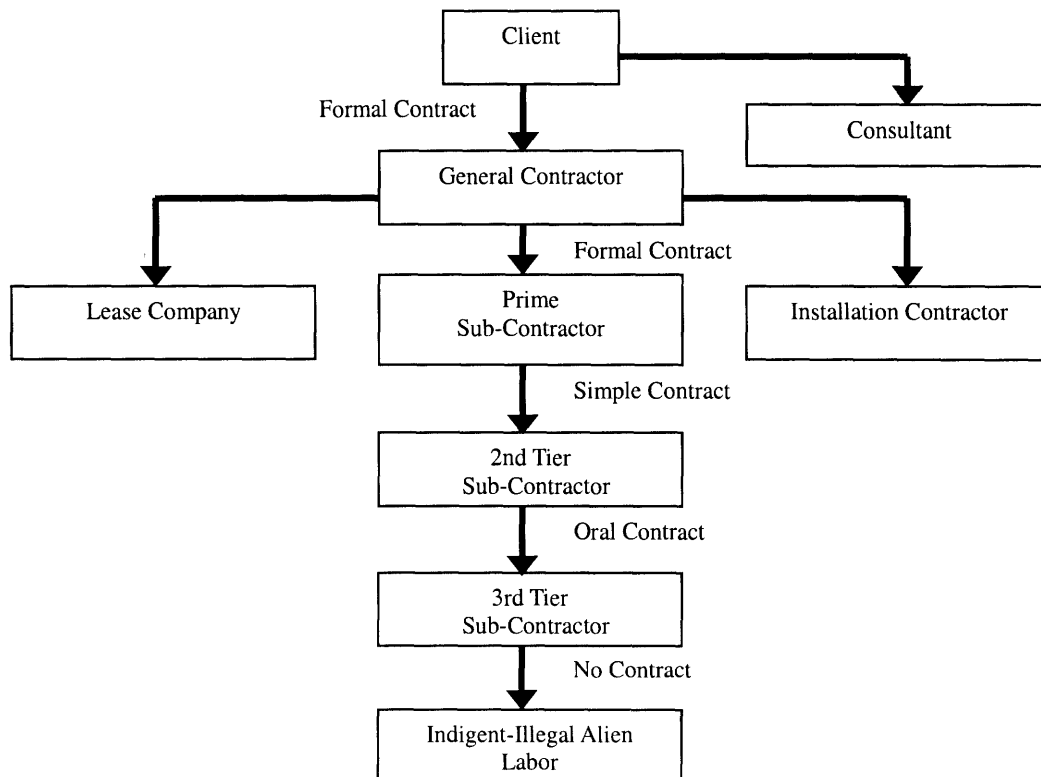


Figure 2-3 Structure of the Japanese Construction Industry

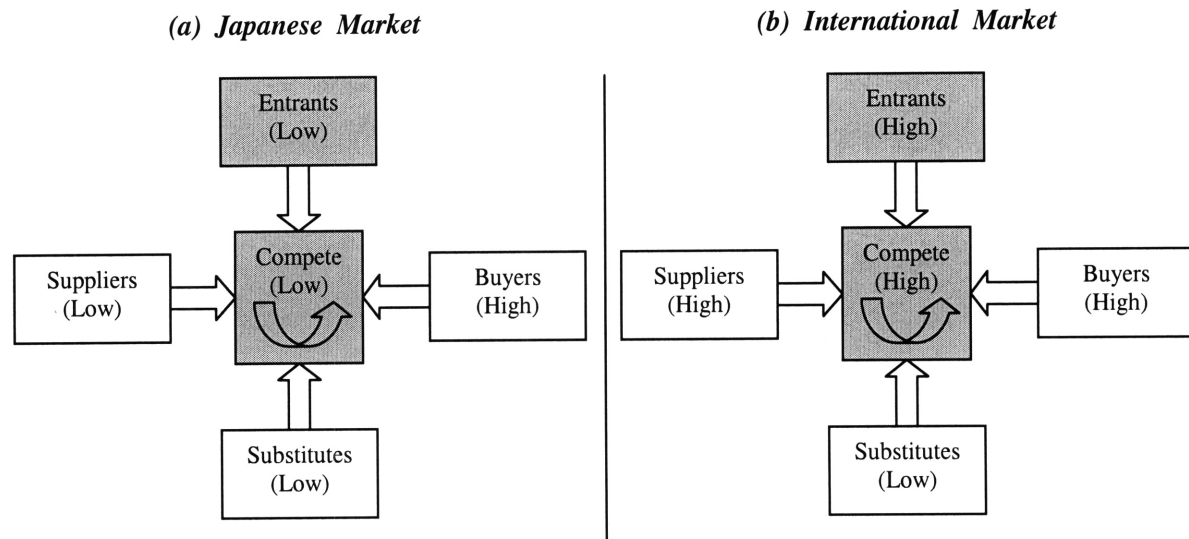
This business custom is unique in Japan and is established from trust and a sense of fellowship. To acquire such traditional and confidential relationships with clients, general contractors and subcontractors tend to undertake small additional jobs without written contracts. This is a reason why there is little or nothing in claiming for breach of contract. Moreover, because contracts are vague according to lower layers, the adjustment in labor forces is conducted from the lowest layers. It depends on economic conditions and investment amounts. These characteristics in contracts are core elements in Japanese construction industry.

When it comes to bidding process in private sectors, there is a tendency that clients repeat orders to the same contractors from their trust relationships. Moreover, because large-scale companies belong to the large business affiliation like Mitsubishi and Sumitomo, they can get orders from firms in the same affiliation under the supervision of the main banks.

When it comes to public bidding process, medium and small-scale firms are guided by the government to get stable orders which are counted as about 50% in total public investments. In terms of large-scale firms, they can also get orders of large-scale construction projects according to the government's initiatives. This means that a free competitive market is not in Japan. Indeed, ranking in sales remains stable for over years or decades. It is still considered to be a taboo to disorganize the Japanese construction industry and to expand a firm's market shares. Although the custom has been changed in recent years, the Japanese construction firms are accustomed to such a unique market and this leads to a difficulty in expanding their market overseas. In the international market, they should improve their skills to compete and cope with claims according to their contracts.

2.3.2 Market Analysis

The construction market can be analyzed for both the Japanese and the international markets, using a framework based on Michael Porter's five forces as shown in Figure 2-4.



*Figure 2-4 Five Competitive Forces of Construction Markets
(Source: Michael E. Porter, 1985)*

a. Entrants (Low in Japan and High in the International Market)

In the international market, entrants are high, comparing to the Japanese market. On the other hand, entry barrier of the Japanese market is relatively high in both private and public works. It is difficult to get a job from a new client because there is a unique business custom as mentioned before. In addition, it is also difficult to get a job from public sector because each large-scale firm has bond rating from past records and qualification according to criteria for each construction type. In recent years, however, the Japanese market has become internationalized, and then foreign engineering firms have entered into the market and started their business focusing on engineering services such as construction management (or CM) for middle to small projects.

Because of the competitiveness in the international market, Section 5.4 argues some strategies to avoid entering into a new market using ROA.

b. Suppliers (Low in Japan and High in the International Market)

In public works in Japan, prices of materials are already decided at the stage of bidding process, so this is not important. In private works, it is not also important because contractors use the same material firms as they used before such as commercial firms. In the international construction, however, there are large volatilities of prices and the Japanese firms should establish a strong relation with suppliers.

c. Substitutes (Low in both Markets)

There would be no substitution for construction because construction is a kind of indigenous industry and there is not exactly the same thing. However, in terms of building structures, there could be considered a lot of methods to build and alternatives. In the international industry, alternatives are important and it is a chance to appeal differentiation among competitors.

d. Buyers (High in both Markets)

From the fact that sales of construction firms depend largely on investment amounts of buyers, buyer power is very high among other forces.

e. Compete (Low in Japan and High in the International Market)

Although there are a lot of contractors in each tier, the industry has been developed and the Japanese construction firms have been able to keep their sales and shares in the market at the initiative of the government. On the other hand, in the international market, it needs a severe competition to expand market shares, which is also analyzed in Section 5.4, using ROA.

2.4 R&D and Development of Human Resources

Although disadvantages of the Japanese construction firms have been argued, they have advantages to compete in the international market. The first advantage is management ability of large-scale construction firms, which has been developed from the multi-tiered structures. The second is engineering ability such as productivity and high technology to compete in the international market. Those advantages come from the long-term investment for R&D and development of human resources.

Different from construction firms in other markets like US and Europe, the Japanese firms have their own research institutes to make a difference among competitors. Researches are a kind of practical, and are also different from ones conducted by national institutes and universities. They have researched focusing mainly on cost efficiency and productivity such as new construction methods. This is the reason why the Japanese construction technology is one of the world leading. However recently, many large-scale firms should keep a lid on cost of R&D because of their shrinking sales. They have begun to do their up to date research with competitors. Kajima, Taisei, and Shimizu tied up for basic researches in 1998, for example. Figure 2-5 shows that investment on R&D is shrinking even though the percentages of it in sales are stable.

Research types are basically different between in Japanese and the international markets. In the Japanese market, new fields of study like environment and maintenance are needed to expand their market share or enter into a new market in Japan. On the other hand, productivity and cost efficiency is more important in the international market especially in Asian countries to cancel disadvantages such as high employment costs and transportation costs, and to enhance their competitiveness.

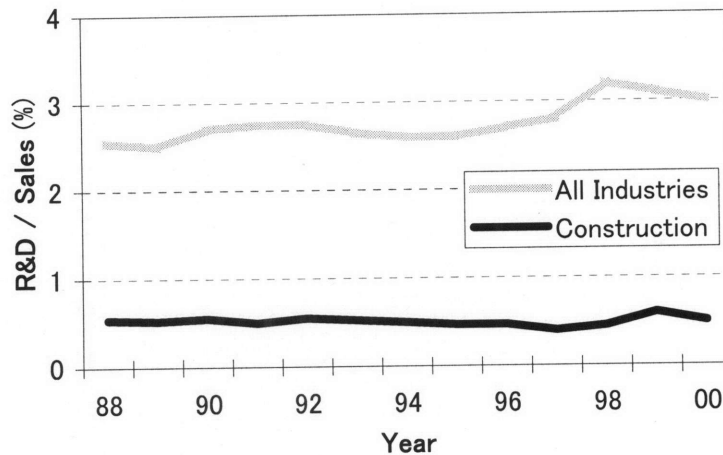


Figure 2-5 Investment for R&D
 (Source: *Construction Industry Handbook, 2002*)

In terms of development of human resources, the Japanese firms have invested to their employees because productivity depends largely on human resources. Indeed, firms have provided practical training programs in addition to on-the-job training. These investments can be done because returns for the investments can be estimated as those for R&D because of their lifetime employment system.

To sum up, Section II shows characteristics of the Japanese construction market including their advantages and disadvantages to expand their market overseas. The advantages are mainly their engineering skills such as high technology, productivity, and management. On the other hand, their disadvantage is that they are accustomed to the unique characteristics of the Japanese industry such as contracts methods and business customs, and they are inexperienced to those in the international market.

CHAPTER III

RISK ANALYSIS IN THE INTERNATIONAL MARKET

3.1 Overview

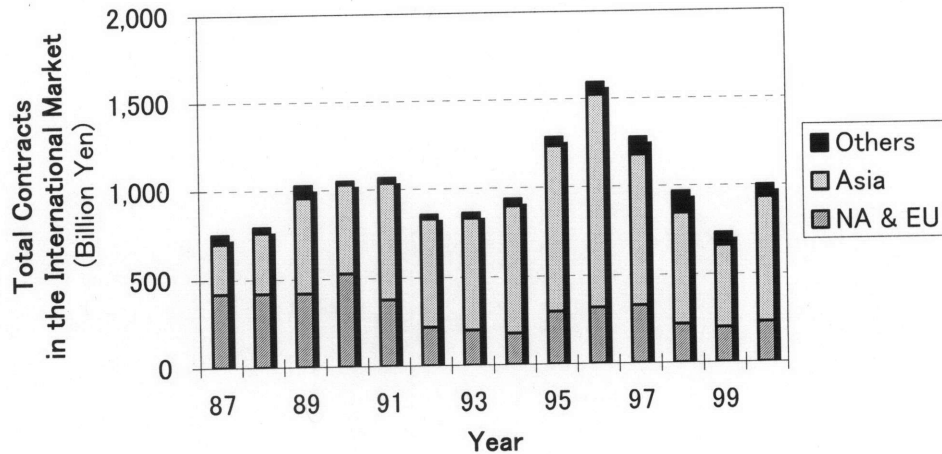
The Japanese construction firms started increasing their sales in the international market at the beginning of 1960's. At that time, the large infrastructure projects started in developing countries, especially in Asia, and oil facilities had also been developed in the Middle-East countries. Because of the market expansion, their sales had been increasing to about 1 trillion yen in 1980's and then the amount has been ups and downs in the last decades.

Figure 3-1 shows total contracts by regions in the last decade and its breakdowns focusing on the construction types and regions for the large-scale firms from 1998 to 2002. By construction types, architecture projects such as factory and office building are counted as 62.9% of total contracts and become the major because, when Japanese manufacturing firms have expanded their market overseas, they have ordered to the Japanese construction firms. This comes from the Japanese business customs as stated in Chapter II. On the other hand, civil constructions such as road and plant are counted as 37.1% of total contracts and have been less than the architecture projects because of high competitiveness for local public works.

Indeed, the construction industry is said to be most backward, compared to other manufacturing companies in Japan. They are gotten a lead on construction using engineering, consulting, and presentation by the Western countries. At the same time, they are also given a lead in cost competitiveness by local and Asian countries like China and Korea. They are considered to be vulnerable to tough international competition. They should more expand their sales from local private and public works by competing with

those foreign firms.

(a) *Contracts in the International Markets*
(NA: North America, EU: European Union)



(b) *Contracts for the Large-Scale Firms (1998-2002)*

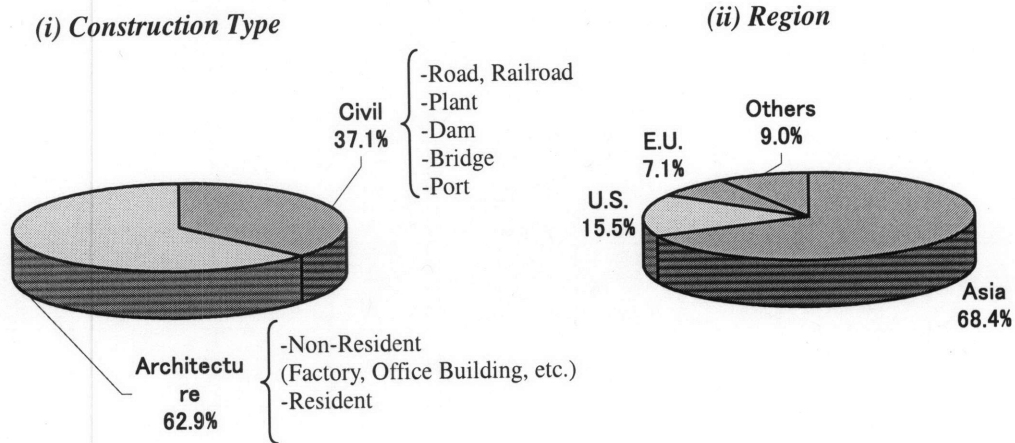


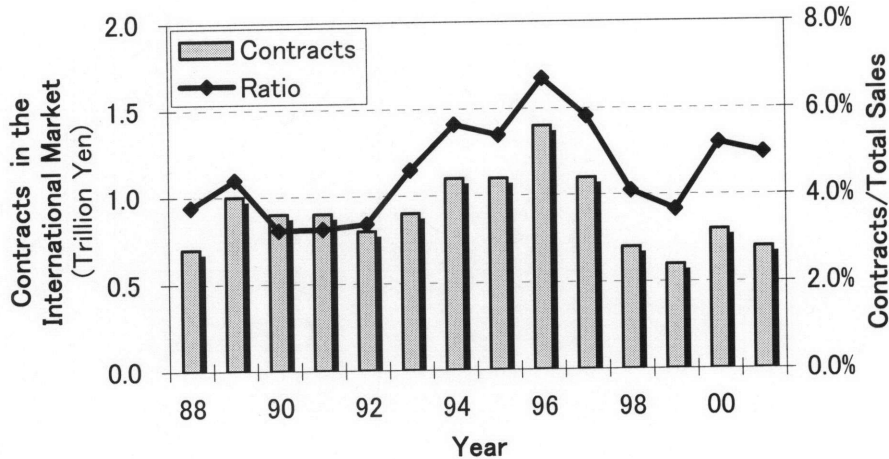
Figure 3-1 Breakdown for Contracts in the International Markets
(Source: The overseas construction association of Japan)

The next sections first analyze the current situation of the Japanese construction firms and then identify risks and its volatilities they have to take in the international market, to compete with foreign firms. By managing these risks efficiently, they could expand their market with improved productivity and then enhance a firm's value.

3.2 Position in the International Market

3.2.1 Total Contracts

Figure 3-2 shows the contracts in the international market for large-scale construction firms in Japan.



*Figure 3-2 International Contract for the Large-Scale Firms
(Source: The overseas construction association of Japan)*

The Japanese large-scale construction firms have been doing their overseas business accounting for about 5% of their total sales. The ratios are much lower than those of the other large-scale firms in the international market as shown in Table 3-1. The reason for the low ratios is that the Japanese firms have been able to keep their sales and manage their fixed assets like employees only in the domestic market. They think overseas construction is not necessary to do their business and it is just considered to be an adjustment to make their sales stable because of unstable order amounts and its risks of the market. Moreover, they have not been accustomed to business customs in the international market. Recently however, almost all large-scale firms set the goal of getting overseas contracts about 10% of their total sales to cope with the shrinking domestic market.

Table 3-1 International Contract Ratios for Top firms in 2001
 (Source: Engineering News Record, 2002)

Rank	Firm's Name	Sales in 2001 (USD)	Ratios of International Contracts (%)
1	Vinci, Rueil-Malmaison, France	15,378	39.2
2	Skanska AB, Stockholm, Sweden	14,342	84.7
3	Bouygues, Guyancourt, France	12,830	44.9
4	Kajima, Japan	12,171	10.6
5	Hochtief AG, Essen, Germany	11,682	81.5
6	Bechtel Group Inc., SF, CA, USA	11,299	35.3
7	Taisei, Japan	11,279	4.2
8	Obayashi, Japan	9,972	7.5
9	Shimizu, Japan	9,893	8.0
10	Takenaka, Japan	8,803	6.9
11	Fluor Corp., Aliso Viejo, CA, USA	7,194	31.5
12	Centex, Dallas, TX, USA	6,284	4.3
13	Halliburton KBR, Houston, TX, USA	5,858	76.0

3.2.2 Contracts by Region and Ownership

This research analyzes contract amounts for the large-scale Japanese construction firms in three main markets such as Asia, US, and EU markets from 1998 to 2002.

a. Asia

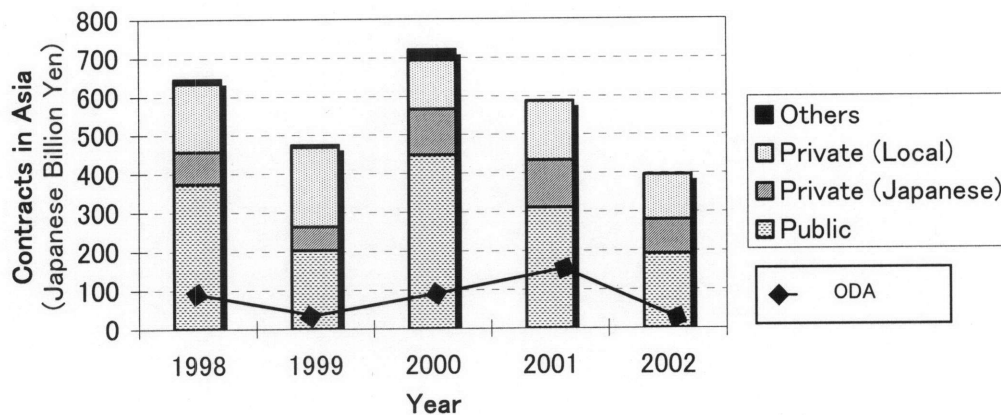


Figure 3-3 Breakdown of Contracts in Asian Market

Asian market has been considered to be most important and accounted for about 68% in total sales for the last 5 years, even though investments have been decreasing after the Asian economic crises in 1997. In terms of construction types, road, railroad, and sewage lines are in relatively high demand from the local governments because the infrastructure has not been enough to develop. The most demanding order of private sectors is factory construction because there exist a lot of manufacturing firms entering into Asian market.

For the Japanese construction firms, however, it is difficult to get a contract because there are a lot of competitors from all over the world and compete each other technically and cost efficiently. Indeed, the Japanese firms have to compete with competitors from US or EU countries using high technology, engineering, and consulting skills. At the same time, they also lose ground in cost competitiveness to local and Asian firms from China and Korea.

In terms of Official Development Assistance (or ODA) from the Japanese government, this region has been most provided, and the tendency will continue in years. Although ODA projects are counted as only about 10% of total sales in the international market, the firms are willing to increase these projects because of their reduced risks.

There are two types of ODA including grants and yen loan. Grants are more demanded among the Japanese firms than yen loan because they can work as they are in Japan. This means that political and economic risks such as currency and payment risks can be reduced because the government certainly pays money to the firms by Japanese yen. However, by yen loan, there remain political risks for payments.

b. United States

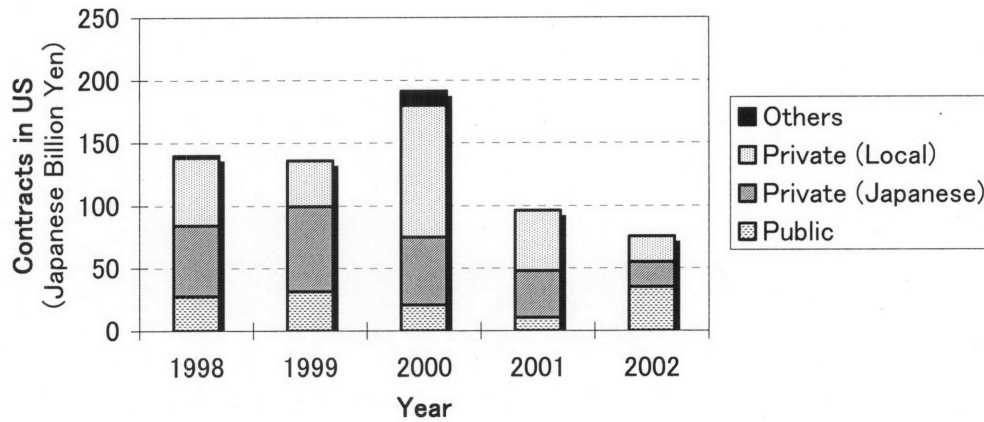


Figure 3-4 Breakdown of Contracts in U.S. Market

The US market has accounted for 15.5% in total sale for the last 5 years, though the amount is decreasing because of the collapse of the IT bubble economy. In terms of ownership, which is different from Asian markets, public construction is at low level and private construction is a mainstream of their projects. Factory and office building are most demanded among other constructions from both Japanese and local private firms.

The Japanese firms have worked as management or construction firms because management and construction firms are separated in the US. The Japanese firms have had a tough ride in this market as management firms. Moreover, they tend to avoid this market because contracts are unique and claims are frequently occurred. It has been difficult for them to enter into this market in terms of contracts. From this reason, there are some cases that large-scale Japanese firms make joint ventures with small local firms to make construction records in the US instead of giving a financial credit to the local firms.

c. European Union

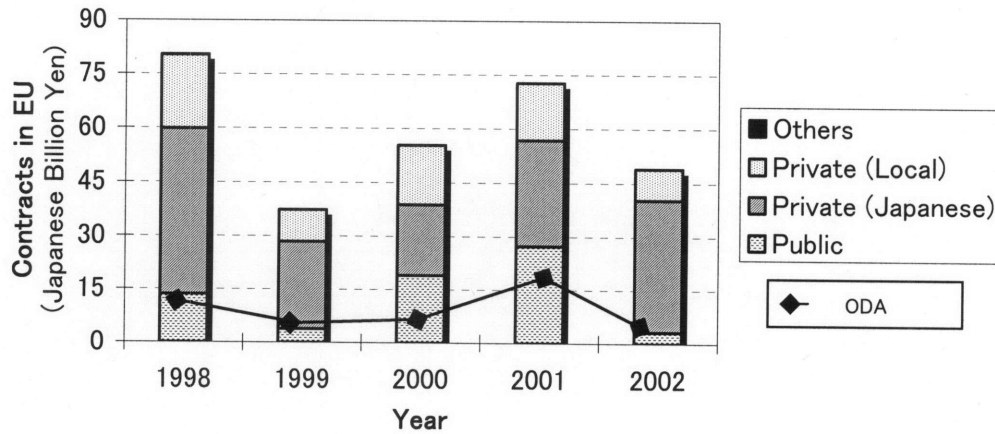


Figure 3-5 Breakdown of Contracts in E.U. Market

The EU market has accounted for 7.1% in total sales for the last 5 years although the amount has been instable. The Japanese firms have gotten orders from other Japanese private firms because the market has already matured and entry barrier is relatively high. Indeed, factory construction is most demanded because there are a lot of Japanese manufacturing firms entering into the EU market.

Both public construction and ODA has been at a low level because total investment of the public construction is small and ODA is little provided only in Romania and Bulgaria. For private projects, the Japanese firms should keep contracts with the Japanese private firms in other industries and, for both public and private projects, they should compete using their advantages such as high-technology engineering.

3.3 Risks and Volatility Analysis

There are a lot of uncertainties in the international business. This section analyzes risks and those volatilities by separating them into two categories of expected risks and unexpected risks. Expected risks can be analyzed and calculated in advance as a volatility factor for real option analysis. Unexpected risks, however, is a kind of contingency, such as natural conditions, design change, claims, and unexpected appearance of competitors. They can also be analyzed by real option to some extent as a weighed average of Black-Scholes values which have sequential dividends, which is stated in Chapter V.

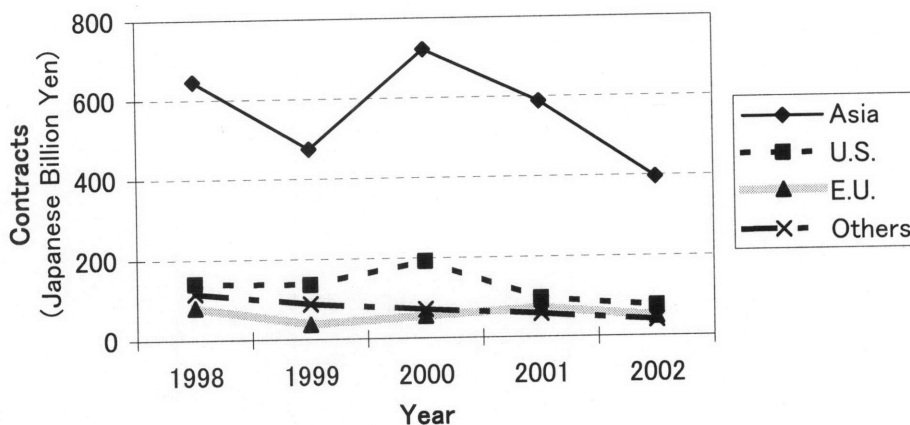
3.3.1 Expected Risks

Expected risks include construction order amounts, currency, interest rate, and political risks, which can be assumed in advance from past data and other information of the market. These risks should be analyzed using Monte Carlo Simulation to summarize them in a volatility factor for ROA.

a. Order Amounts

Total amount of orders in each country is closely related to its global economic conditions. That is, the volatilities can be assumed in advance from economic information. In entering into a new market, however, managers should analyze the volatilities more in detail. Figure 3-6 shows contracts of the large-scale Japanese firms from 1998 to 2002. Volatilities of the contracts are different in each region and in each country. This means that volatility of order amounts is different in each construction type, ownership, and other factors. Because there exist a lot of option values according to them, managers should make a decision to maximize a portfolio of option values, considering the market volatility in detail.

(a) Contracts by Regions



(b) Contracts by Asian Countries

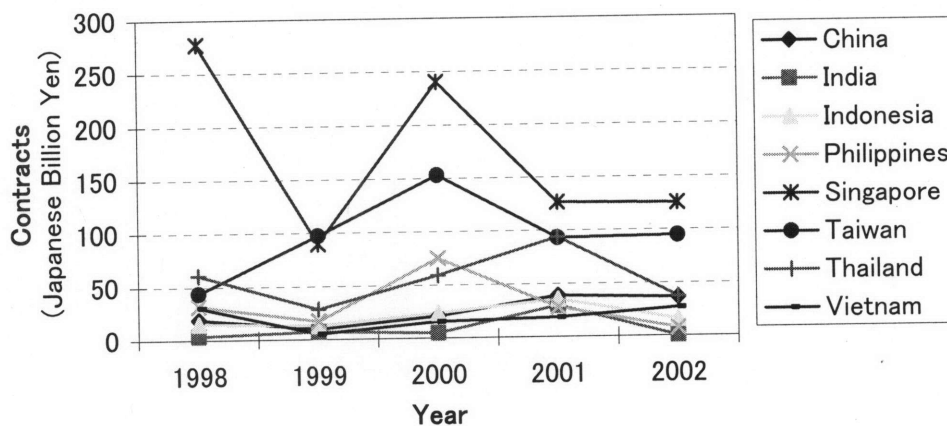


Figure 3-6 Volatility in Contracts

b. Interest Rate and Currency

Interest rate is used to calculate risk free rate, and currency should be considered in calculating volatility analysis in ROA. Although analyzing interest rate and currency is also important to calculate real option values, they are very difficult to measure. They are unstable especially in developing countries. These volatilities can be assumed from economic conditions such as GDP growth rate, inflation rate, and purchasing power of parity for each country.

c. Political Risks

Political risks, which are considered credit risk of each country, occur because of policy changes of the government and are not related to firm's management. Political risks are important to make a decision to invest, so the risks should be considered in volatility analysis in ROA according to risk ratings issued by a lot of institutions as shown in Table 3-2.

*Table 3-2 Country Risk Rating in Asian Countries
(Source: Institutional Investors, 2002)*

Country	Rating	Ranking
China	57.6	38
Indonesia	21.6	102
Philippines	42.4	65
Singapore	84.8	19
Taiwan	73.0	24
Thailand	48.2	56

3.3.2 Unexpected Risks

Unexpected risks occur both in contracts and in competitive markets. Unexpected risks are a kind of contingency and they cannot be assumed in advance. The key to solve these contingencies is in contracts between owners and contactors because, in the international business situation, contracts are most important among them. This volatility can be treated as uncertainty of dividends in ROA and calculated as a weighed average of Black-Scholes values that have sequential dividends.

Moreover, unexpected competition can also be analyzed in the same way using ROA. Competition analysis is stated in detail in Chapter V.

CHAPTER IV

VALUATION FOR PROJECTS/FIRMS USING DCF METHOD

4.1 Overview of DCF Method

When valuing a new project in the Japanese construction market, managers do not have to pay much attention to uncertainty of the project because there are a wealth of historical data and information of the similar projects and there is no estimated economic or political risk as stated in Chapter III. This means that DCF method can be applied to valuing projects and firms in Japan because of the certainty of each project. On the other hand, uncertainty of a project should be valued using Real Option Analysis (or ROA) for a new kind of projects in Japan or all projects in the international markets (Chapter V). This chapter focuses mainly on valuing projects and firms in Japan using DCF method.

DCF method is conducted basically by analyzing future cash flow of a project and its discount rate and by calculating its Net Present Value (or NPV). Future cash flow of the project is analyzed by evaluating past performances of similar projects or all information related to the project. Discount rate is analyzed from Weighed Average Cost of Capital (or WACC), which represents the average discount rate of all projects of the firm. That is, both future cash flow and discount rate are calculated from financial statements which represent firm's total past performance because NPV has a characteristic of additivity. Discount rate, however, is sometimes adjusted from the situation of the project, depending on whether it is more uncertain or not. Discount rate is higher as uncertainty of the project is higher. Figure 4-1 shows the calculation flow of DCF method. The value of a project in the Japanese market can be calculated from future cash flow and discount rate, which can be evaluated by comparing to past similar projects and by examining financial statements.

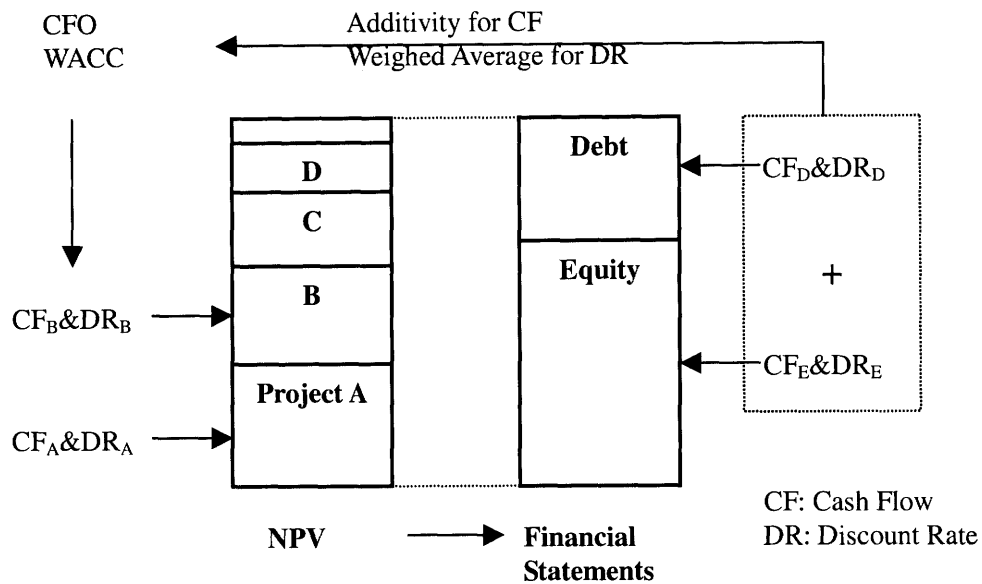


Figure 4-1 DCF Method

Moreover, when valuing a firm, it is calculated by simply adding NPV of each project or by calculating NPV from future cash flow from operation (or CFO) and WACC. Both methods lead to the same result because NPV calculated from DCF method has a character of additivity.

This chapter first shows how to analyze historical performance of a firm from financial statements such as balance sheet and income statement in order to calculate future cash flows and WACC. In calculating a value of the project or a firm, it should be separated in two periods, because future cash flow can only be analyzed by setting a scenario in a forecasting period. A value over the period is separately calculated as a continuing value and is added to the value calculated from the future cash flow in the forecasting period for the total value of the project or the firm. Moreover, the evaluation process of the firm should be adjusted to unique characters of the Japanese accounting method including uncommercial assets and off-balance-sheet liability. Valuation using DCF method is followed as shown in Figure 4-2. In addition to valuing a project or a firm, this chapter also develops the evaluation methods using financial indexes of EVA or EP using ROIC and growth rate to maximize the firm's value.

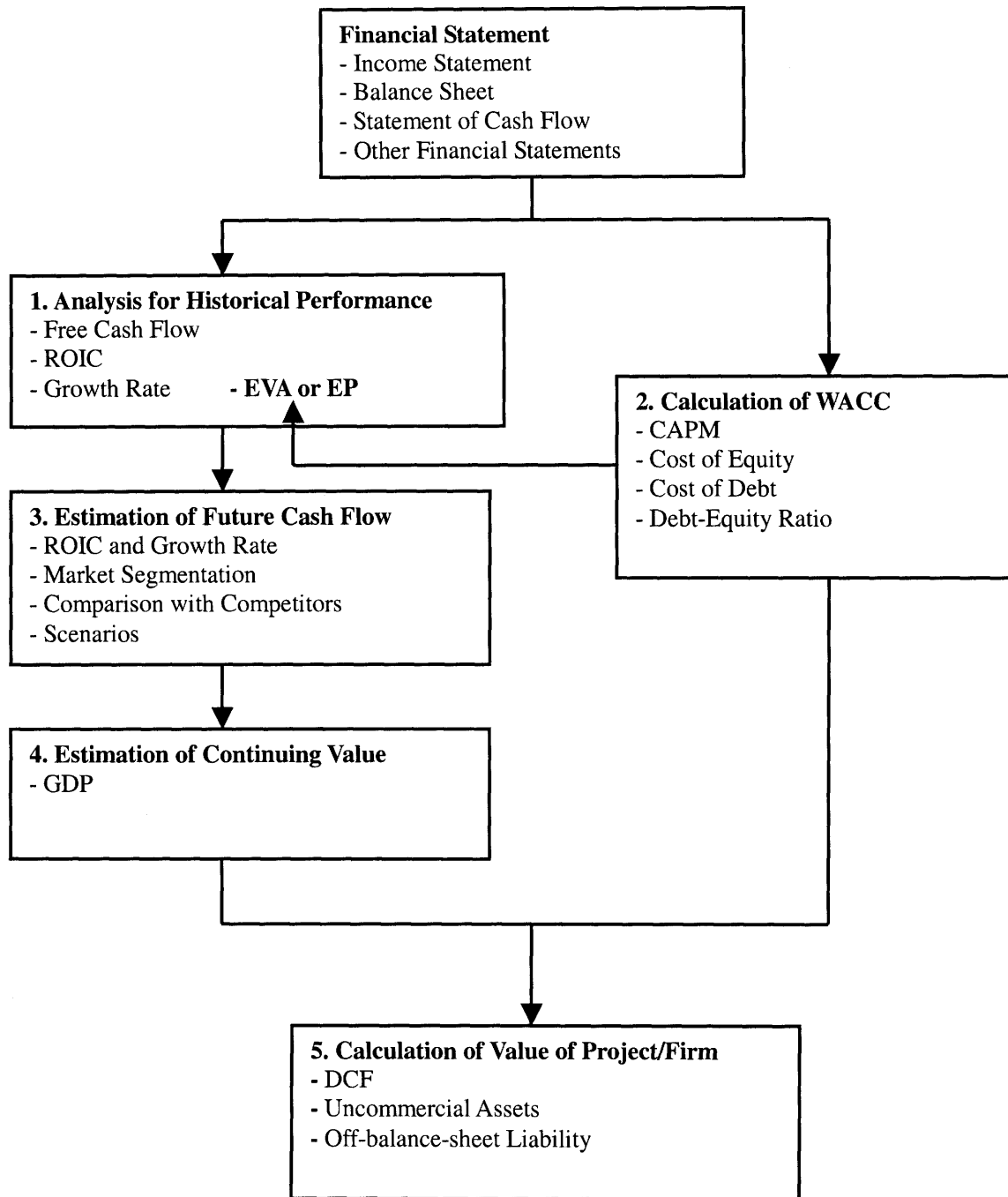


Figure 4-2 Flow of Calculating Value of Project/Firm

4.2 Analysis of Historical Performance

To analyze a firm's historical performance, all financial statements should first be analyzed and restructured, including not only balance sheet and income statement but also schedules of tangible and intangible fixed assets. This comes from the reason why managers might make a mistake in forecasting a future cash flow because the Japanese accounting methods have been revised many times and it is difficult to capture a value with one financial index. In addition, there are many cases that each firm has unique items in financial statements to which managers should pay attention. This section lists some important financial indexes to evaluate a firm's performance.

4.2.1 Net Operating Profits Less Adjusted Taxes (or NOPLAT)

The Japanese firms tend to use ordinary profit as a management index, however, operating profit is better for use in evaluating the firm's performances. NOPLAT is calculated from Earning before interest, tax and amortization (or EBITA).


$$\text{NOPLAT} = \text{EBITA} - \text{Corporate Income Tax} + \text{Change in Differed Tax}$$

Change in differed tax is added to EBITA in order to calculate actual operating profit by investing to a project.

4.2.2 Invested Capital

Invested capital is calculated as total assets for all investments, and it could also be calculated from Debt portion of the balance sheet.

$$\text{ROIC} = \text{Shareholder's Equity} + \text{Liability with Interest} + \text{Other Equities}$$


**Total Depreciation of Goodwill,
Deferred Tax etc.**

Other equities include total depreciation of goodwill, deferred tax, and other equities that can be used for reinvestment. Deferred tax, for example, can be used for their reinvestment because a firm owns it before paying taxes.

4.2.3 Free Cash Flow from Operating Activity

Because the total sum of cash flows from operating activities should be equal to the amount that a firm pays to both creditors and shareholders, cash flow from operating activities should be calculated by checking the equation below as needed.

$$\begin{aligned} \text{Cash Flow from Operating} + \text{Cash Flow from Non-operating} \\ = \text{Cash Flow from Financing} \end{aligned}$$

Cash flow from operating activities has been regulated to be open to the public since the fiscal year of 1999 in Japan, so balance sheets and income statements need to be analyzed in case of calculating cash flows from operating before the fiscal year.

$$\begin{aligned} & \text{Free Cash Flow from Operating} \\ & = \text{NOPLAT} - \text{Net Investment} \\ = & [\text{NOPLAT} + \text{Depreciation}] - [\text{Net Investment} + \text{Depreciation}] \\ & = \text{Gross Cash Flow from Operating} - \text{Total Investment} \end{aligned}$$

Free cash flow from operating activities is independent of capital structure of the firm, so the effects of capital structure should be included in WACC to adjust it.

4.2.4 Return on Invested Capital (or ROIC)

ROIC can be simply calculated from NOPLAT and Invested Capital which are analyzed above.

$$\text{ROIC} = \text{NOPLAT} / \text{Invested Capital}$$

It is difficult to evaluate project-level performance of a firm if Return on Asset (or ROA) or Return on Equity (or ROE) is used. In calculating ROA, interests are not included in net income, however, total asset includes the debt which does not have interests, so ROA does not represent the project-level performance. Moreover ROE also does not represent the performance, because it is affected by capital structure of the firm. ROIC, however, makes it possible to directly evaluate the performance by comparing to that of competitors annually.

As following, RIOC can be rewritten using cash-based tax rate.

$$\text{ROIC before Tax} = \underbrace{(\text{EBITA} / \text{Sales})}_{\text{Operating Profit Margin}} \times \underbrace{(\text{Sales} / \text{Invested Capital})}_{\text{Asset Turnover}}$$

In evaluating a firm's strategy or a project itself, past performance of the firm can be evaluated by decomposing ROIC into Operating Profit Margin and Asset Turnover. That is, operating profit margin shows how efficiently the firm makes a profit from their sales and asset turnover shows how efficiently the firm uses the invested capital. This method is useful in evaluating a firm's differentiation strategies in the existing market or in a new market.

4.2.5 Growth Rate of Operating Profit

Growth rate of operating profit can be calculated as follows.

$$\begin{aligned} \text{Growth Rate of Operating Profit} &= \text{NOPLAT}_{n+1} / \text{NOPLAT}_n \\ &= \text{Return on Additional Investment} \times \text{Investment Ratio} \end{aligned}$$

The effect of growth rate of operating profit and ROIC on a firm's value is shown in Figure 4-3.

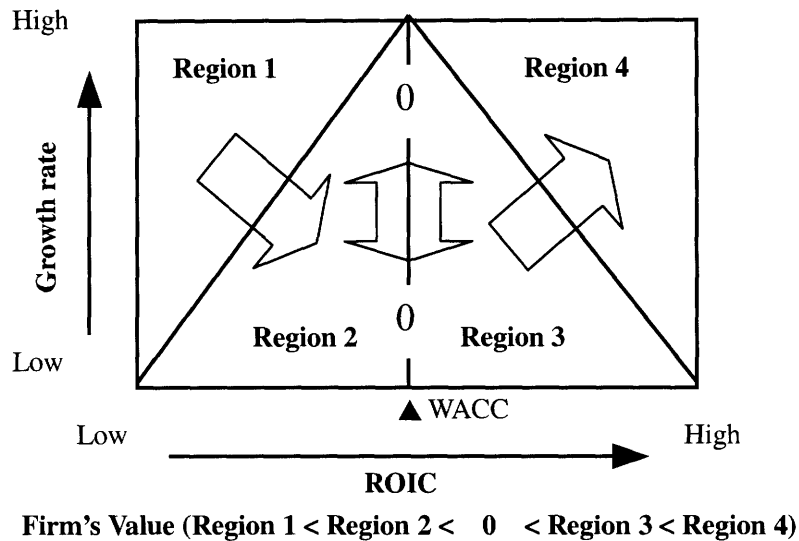


Figure 4-3 Firm/Project Value and WACC/Growth Rate

In case that return of additional investment (ROIC) exceeds WACC, a firm's value becomes higher and above 0 as growth rate is higher. In case that ROIC is below WACC, however, the value become lower and below 0 as growth rate is higher. In case that ROIC equals WACC, the value is same regardless of growth rate. These results become clearer by calculating EVA or EP as stated in Section 4.2.6.

4.2.6 Economic Value Added (EVA®) or Economic Profit (EP)

Almost all managers of the Japanese construction firms believe that value of the firm becomes higher as profit of each project becomes higher. Therefore, they have invested to high-profit but low-rate of return projects to manage their firms and to retain their employees that are their low-liquidity asset and made up of a majority of their fixed assets. Considering this strategy from a view of a firm's value, however, they have reduced their firm's value. This comes to realize by calculating Economic Value Added (EVA®) or Economic Profit (EP). The firm's value becomes higher only when NPV of a

project is positive. That is, only when expected rate of return (ROIC) exceeds WACC, the value becomes higher. WACC is called hurdle rate in this sense.

Managers should realize it in selecting a project and reevaluate their projects. Indeed, investment should not be made in which EVA and EP become negative.

$$\text{EVA} = \text{Residual Income} = \text{NOPLAT} - \text{WACC} \times \text{Invested Capital}$$

$$\text{EP} = \text{Invested Capital} \times (\text{ROIC} - \text{WACC})$$

EVA and EP have been promoted with their own concepts by each consulting company, Stern&Stewart and Mckinsey&Co respectively. Both are the same thinking as residual value.

The strategies to make EVA or EP higher and create firm's value are the followings.

1. ROIC should be increased while invested capital is not increased.
2. WACC should be reduced. (WACC is affected by capital structure, so the current capital structure should be optimized.)
3. NOPLAT or its growth rate should be increased while ROIC is exceeding WACC.

However, managers should remember that EVA or EP and firm's value are basically different because EVA and EP are calculated from the firm's historical performance but firm's value is calculated from future cash flows that represent shareholder's expectations.

4.3 Calculation of WACC

It is important but complicated to calculate WACC for evaluating projects and firms. In developed countries like Japan, WACC can be calculated from the following formula assuming that all stocks the firm issues are common stock and that cost of debt with interest is considered as long-term debt. These assumptions come from the fact that there can be a deduction of tax interests in Japan.

$$WACC = r_D(1 - T_c) \frac{D}{V} + r_E \frac{E}{V}$$

where, r_D : Cost of Debt
 T_c : Marginal Corporate Tax Rate
 r_E : Cost of Equity
 D : Debt
 E : Equity
 V : Total Market Value of the Firm ($V=D+E$)

Indeed, WACC calculated from this formula does not represent risk of each project, but shows the average risk of all projects and risk of the firm itself. That's why the WACC can be applied as a discount rate for a project that has the average risk of the firm. Managers should pay attention to how to apply the WACC as a discount rate for each project, in case that interest rates change because of the capacity of borrowing for each project and that the capital structure of the firm changes for each project.

This section focuses on unique characters of the Japanese market especially in terms of capital structure and costs of equity and debt. In calculating cost of equity, for example, CAPM is usually used in Japan, considering unique characteristics of risk free rate, market risk premium, and beta.

4.3.1 Capital Structure

Debt to equity ratios of most Japanese construction firms are over 5.0 as stated in Section 2.2. That is, many construction firms are deeply in debt without their fixed assets. This leads to make WACC higher even if tax shield is considered. Figure 4-4 shows that cost of debt becomes higher as debt to equity ratio becomes higher because of the firm's financial risks and the cost of financial distress encountered at high debt levels. This is a kind of spiral in which WACC and debt to equity ratio become higher simultaneously because as WACC becomes higher and firm's value is lower, debt to equity ratio becomes higher.

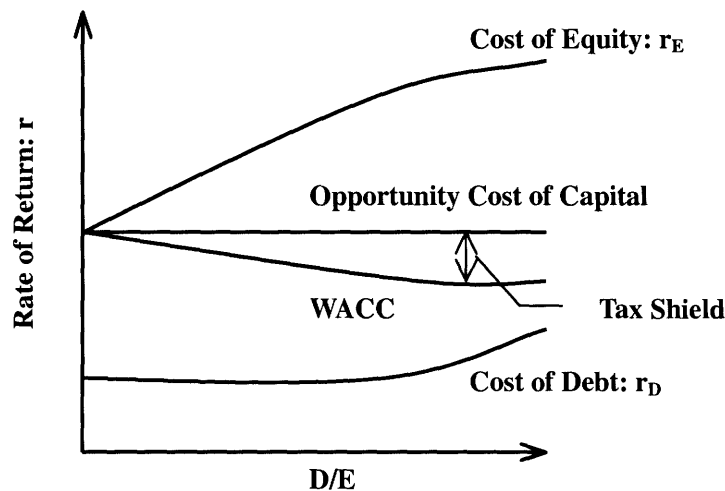


Figure 4-4 WACC and Debt to Equity Ratio

In calculating WACC for a firm, target of capital structure is used and the current structure is not applied. Moreover, it is important to compare WACC to that of the other similar firms.

4.3.2 Cost of Equity

a. Risk Free Rate

Japanese government bonds were downgraded from AAA and its grade becomes Single A in April 2003. In Japan, risk free rate is calculated based on a yield of 10-year maturity

bond and its credit premium. The yield of 10-year maturity bond is 0.60% in April 2003 as shown in Figure 4-5 and credit premium for single A grade is assumed to be 0.1% for two grades down. Then risk free rate is calculated as $0.6 - 0.1 = 0.5\%$. This figure can currently used but should be checked as needed.

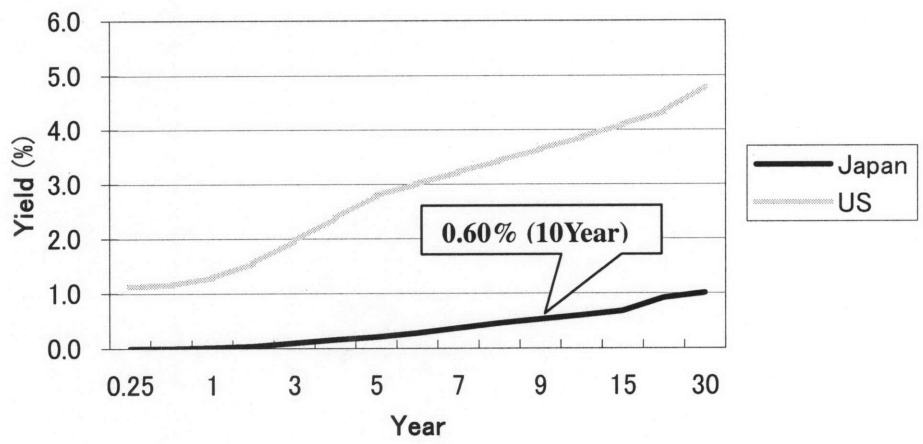


Figure 4-5 Yield Curve of Japanese Government Bonds and US Treasury Bills (Source: Bloomberg.com)

b. Market Risk Premium

The average difference between yield of new Japanese government of 10year bond and the average return of the firms in Tokyo Stock Exchange in the past 20 years has become 5.5% as presented in journal issued from TOPIX. Moreover, risk premium in US stock market is about 5.0%, so market risk premium is assumed as 5.0%, considering recessions of the Japanese economy.

c. Beta

The beta of the Japanese construction firms is presented in the journal issued from TOPIX. These are an example of betas of the major construction firms in Japan.

*Table 4-1 Betas of the Major Japanese Construction Firms
(Source: msn.co.jp)*

Name	Beta	Name	Beta
Nishimatsu	0.08	Taisei	0.64
Kajima	0.31	Sumitomo	0.65
Obayashi	0.36	Tobishima	0.80
Maeda	0.49	Kumagai	0.84
Toa	0.55	Penta Ocean	0.92
Shimizu	0.60	Hazama	1.79

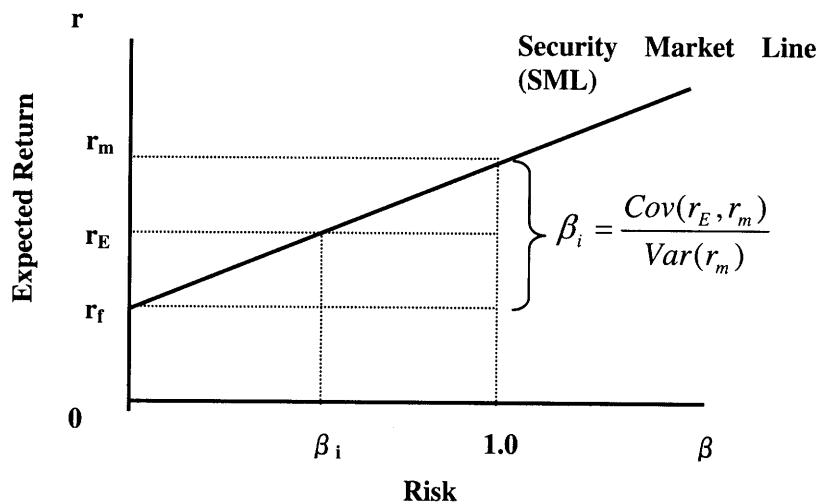


Figure 4-6 Capital Asset Pricing Model

Cost of equity can be calculated from the formula below with risk free rate, market risk premium, and beta for a firm. The formula comes from the Capital Asset Pricing Model (CAPM) as shown in Figure 4-6.

$$r_E = r_f + \beta_i (r_m - r_f)$$

where, r_E : Cost of Equity
 r_f : Risk Free Rate
 r_m : Market Risk
 β_i : Beta for the Asset i

4.3.3 Cost of Debt

In addition to cost of equity, cost of debt can be calculated as assumed from risk free rate in Figure 4-5. That is, cost of debt is calculated from a firm's rating and a cost of long-term debt because most percentage of the debt comes from its main bank. Because credit premium for BBB grade is currently 0.2 to 0.3%, cost of debt for the Japanese construction firms in this range can be calculated as about $0.5 + 0.3 = 0.8\%$. Table 4-2 shows Moody's ratings of the major Japanese construction firms in April 2003.

*Table 4-2 Rating of the Major Japanese Construction Firms
(Source: moody's.com)*

Name	Beta	Name	Beta
Taisei	Ba1	Nishimatsu	Baa1
Obayashi	Baa2	Maeda	Baa3
Shimizu	Baa3	Toda	-
Kajima	Baa3	Penta Ocean	B1

From the above calculations, WACC can be calculated considering a firm's goal of capital structure, cost of debt, and equity, and corporate tax rate.

4.4 Forecast of Future Cash Flows

Future cash flows of a project in Japan should be forecasted in a period of time according to historical performances of the firm, because there are a lot of historical data and information, and because uncertainty of the project is at low level. As stated in this chapter, to analyze the historical performances of the firm, managers should focus on ROIC and growth rate calculated from financial statements.

After analyzing historical performances, managers should make a few scenarios targeting on a segmented market. In forecasting their cash flows, it is important to set their future goals according to their marketing strategy or productivity strategy. After setting their strategy, they should segment their market, understanding their positions in the industry, comparing to competitors, and coordinating them with past performances. For example, market should be segmented as shown in Figure 4-7.

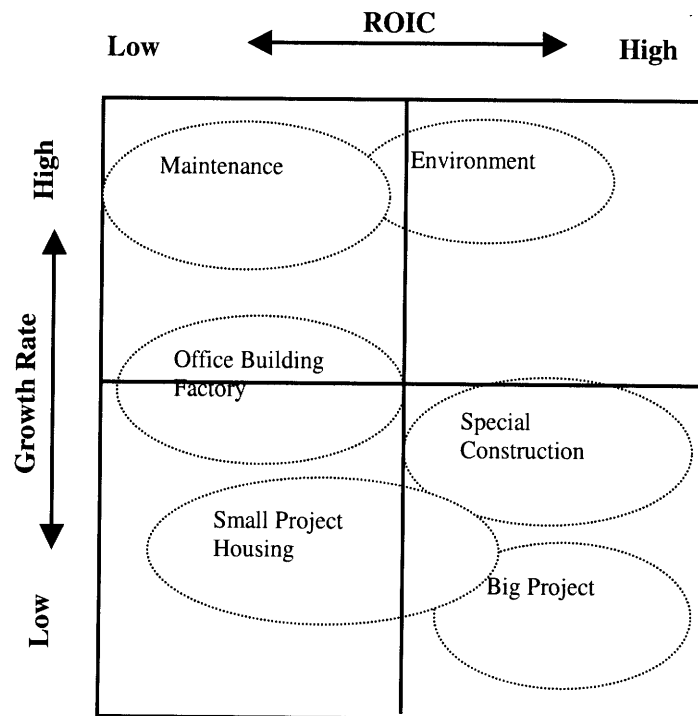


Figure 4-7 Market Segmentation in the Japanese Construction Industry

As stated in Chapter II, volatility of orders in the construction market is closely related to economy in Japan. Moreover, to cope with the shrinking market, construction firms should enter into a new market in Japan or in the international markets to keep their growth rate or they should improve their productivity represented as ROIC. They should select their strategy from the two or both.

After segmenting their market, they should make some scenarios of each target in the market and examine the cash flows considering the volatility of orders in the forecasting period of time.

4.5 Calculation of Continuing Value

After setting their scenarios and analyzing future cash flows for them, managers should also calculate continuing values occurring after the forecasting period of their scenarios.

Continuing value is calculated from the following formula, assuming a constant growth rate and ROIC.

$$\text{Continuing Value} = \frac{FCF_{T+1}}{WACC - g} = \frac{NOPLAT_{t+1}(1 - g / ROIC_i)}{WACC - g}$$

where, FCF_{T+1} : Future Cash Flow at one year after forecasting period

4.6 Project Evaluation using DCF Method

The project or firm's value is calculated as a sum of present value of the forecasting cash flows and the continuing value, using discount rate of WACC.

In calculating not a project's but a firm's value, there are some cautions because of the Japanese business customs and accounting systems. As stated in Chapter II, Japanese firms have a lot of uncommercial assets such as cross shareholding which is originated from the Japanese business customs. To evaluate the firm's value, uncommercial assets should be calculated correctly and should be deducted from the value of the firm.

For example in the construction industry, because a majority of their fixed assets consists of their employees, off-balance sheet liability such as past service liability should be deducted from the value of the firm. Off-balance sheet liability includes annual pension, severance, investment to derivatives, and so on. Uncommercial assets include deposit money, stocks, funds, real estate, and so on. Managers should deduct these off-balance sheet liability and uncommercial assets to correctly value their firms.

CHAPTER V

VALUATION FOR INTERNATIONAL PROJECTS USING ROA

5.1 Overview of Real Option Analysis (or ROA)

Because of the uncertainties in the international market, DCF method has many disadvantages for applying to evaluate a project and a firm itself. In DCF method, for example, a fixed discount rate is calculated based on WACC, although it would be changed according to project's capital structure and market situations. Moreover, to forecast cash flow with a future scenario cannot be changed as market situations change such as construction orders, currency, and so on. That is, WACC is only useful in a certainty market like in the existing Japanese market.

From this reason, projects in the international market should be evaluated using ROA rather than DCF method because ROA can evaluate and quantify flexibility of manager's decision-makings. Moreover, this analysis eventually gives managers useful indexes for maximizing their firm's value by developing a portfolio value of each project considering the valuation of synergy effects of simultaneous projects, interdependence between sequential projects, and interactions in competitive markets. This Chapter focuses on applying ROA for international projects after clarifying disadvantages of DCF method and explaining basic ideas of ROA.

5.1.1 Disadvantages of DCF Method

Chapter IV has developed in valuing projects and firms by forecasting cash flows and calculating WACC in DCF method. However, it still has some disadvantages in uncertainty markets as follows.

a. Changes in project risks cannot be adjusted as time goes on. That is, WACC, which

represents the average risk of a firm, is continuously changing.

b. Complicated calculations of tax and inflation effects cannot be included in the valuation.

c. In an uncertain market, each future cash flow is assumed from a scenario respectively, so DCF method needs to make a lot of scenarios according to the volatility of market changes. This leads to miss adjusting to the valuation to the market changes.

d. Investments are assumed to be irreversible and DCF method cannot consider the valuation of reversible investments.

e. The method cannot calculate the valuation of synergy effects of simultaneous projects and interdependence between sequential projects. This fails to make a strategy and control objectives for maximizing the firm's value.

DCF method can be applied only in certainty markets like the Japanese market because there are a lot of past data, and firm's risks can be assumed in advance. When a firm is entering into a new market or exists in the international market, however, ROA is better for use in such an uncertainty market because there are a lot of volatilities of economic and political risks, which cannot be easily assumed. This chapter focuses on ROA to overcome the disadvantages of DCF method.

5.1.2 Financial Option and Real Option

Financial option is defined as follows.

“Financial option gives its owner the right but not obligation to buy or sell stock or other assets at a specified exercise price on or before a specified exercise date by paying a certain amount of money.”

If the option can be exercised only on one particular day, it is called “European Option”. If the option can be exercised on or at any time before that day, it is called “American Option”. Moreover, the right to buy stock is called “Call Option” and the right to sell is called “Put Option”. In either option, the most important thing is that, because its owner has right but not obligation, options have asymmetry values. Real Option is a method to value projects and firms by applying these characters of financial options to real assets. Figure 5-1 shows the values of call and put options and calculation methods are defined as follows.

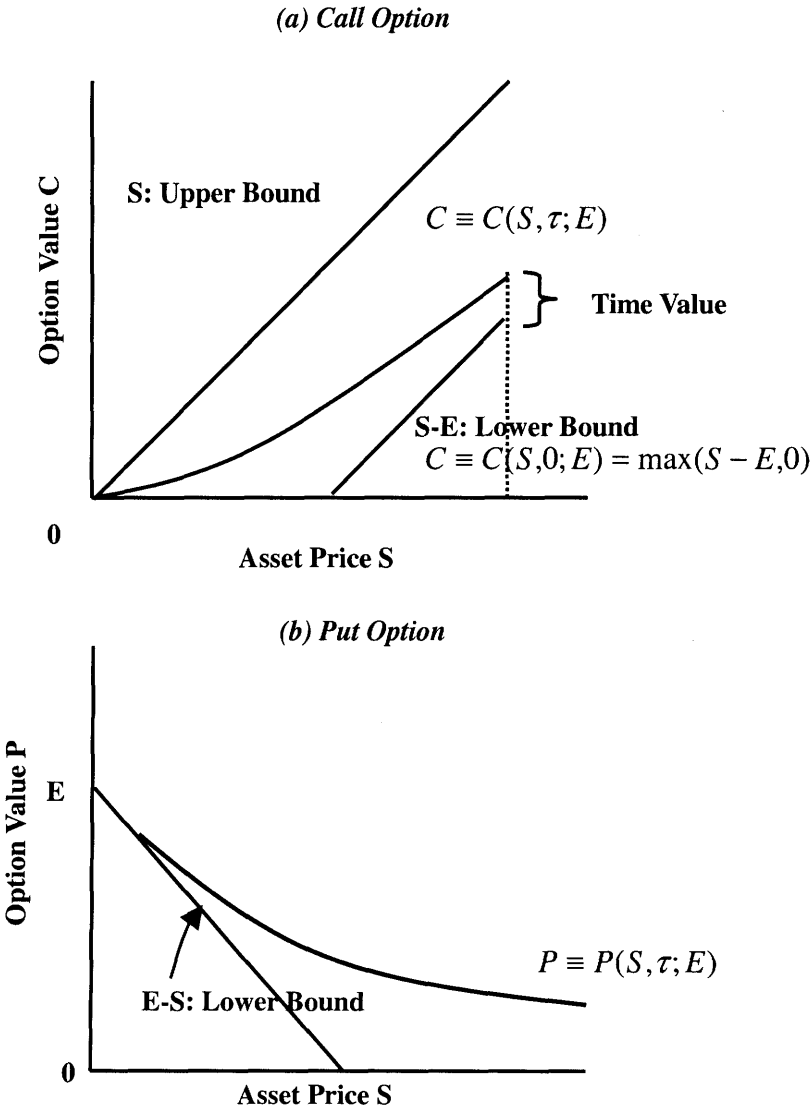
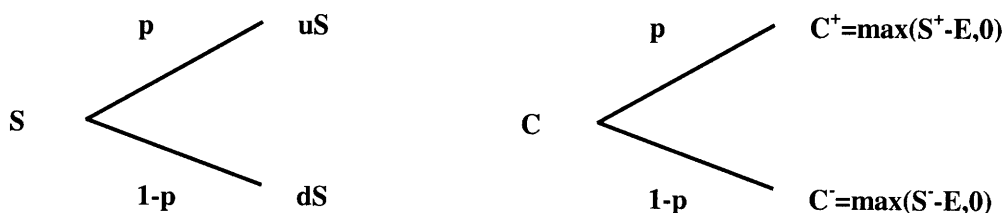


Figure 5-1 Option Value

Variables deciding the option values are defined as follows.

$C \equiv C(S, \tau; E)$: Value of American Call Options
$c \equiv c(S, \tau; E)$: Value of European Call Options
$P \equiv P(S, \tau; E)$: Value of American Put Options
$p \equiv p(S, \tau; E)$: Value of European Put Options
$S \equiv S_t$: Price at Time t
T	: Exercise Date
τ	: Term until Exercise Date ($= T - t$)
E	: Exercise Price
r	: Risk Free Rate

a. Binomial Trees at Discrete Time



$$C = \frac{\sum_{j=0}^n \frac{n!}{j!(n-j)!} p^j (1-p)^{n-j} \max(u^j d^{n-j} S - E, 0)}{(1+r)^n}$$

$$\text{where, } p = \frac{(1+r) - d}{u - d}$$

b. Black-Scholes Formula at Continuous Time

$$C = SN(x) - E(1+r)^{-\tau} N(x - \sigma\sqrt{\tau})$$

$$\text{where, } x = \frac{\ln(S/E(1+r)^{-\tau})}{\sigma\sqrt{\tau}} + \frac{1}{2}\sigma\sqrt{\tau}$$

c. Call-Put Parity Formula

$$S + p(S, \tau, E) - B(\tau)E = c(S, \tau, E)$$

$$\text{where, } B(\tau) \equiv e^{-r\tau}$$

d. Adjustment for Dividends

In case of no dividend, American call option should be held until its exercise date because the value at the date is higher than that before the date, which is calculated from Black-Scholes Formula. So, the value of American option is the same as that of European option. However in case that there is a dividend and the value of the dividend can be expected, NPV of the expected dividend should be calculated and then subtracted from the original value of the asset. That is, S^* is calculated as a price of the asset and entered into Black-Scholes Formula instead of the original price of the asset, S .

$$S^* = S - \sum_j D_j e^{-r\tau_j}$$

e. Risk-Free Rate

In ROA, risk free rate is used as a discount rate instead of WACC in DCF method because of the risk neutral valuation.

Each country has a different risk-free rate and, especially in developing countries, the rate needs to be adjusted from country risks and from the US treasury bills as follows.

$$r = \text{Interest Rate of the US Treasury Bills} \\ + \text{Difference of Inflations between the US and the Local Country}$$

The US treasury bill of 10 years is 3.86% in April 2003. Risk free rates of each Asian country are calculated in Table 5-1.

Table 5-1 Risk Free Rates in Asian Countries
 (Source: Shinkin Central Bank, 2002)

Country	Inflation* (%)	Difference With US	Risk Free Rate (%)
USA	2.52	0.0	3.86
China	(0.38)	(2.90)	0.96
Indonesia	11.77	9.24	13.10
Philippines	5.24	2.72	6.58
Singapore	0.65	(1.87)	1.99
Taiwan	0.50	(2.02)	1.84
Thailand	1.27	(1.25)	2.61

*Inflation is calculated at compound interest from 1999 to 2002

5.2 Risks Evaluated by ROA

As stated in Chapter III, risks and uncertainties in the international market, which can be evaluated by ROA, stem from volatility of its economic situation such as construction order, currency, and interest rate, and also stem from volatility of political situation such as country risks and political risks. Because they are directly affected by economic and political environments, the volatilities could be expected from analyzing past data and collecting information for each market.

Markets are evaluated from these volatilities which can be summarized as one valuable using Monte Carlo numerical simulation. In other words, according to the business climate in the market, managers can decide the timing to enter into a new market (Option to Defer), to expand or contract (Option to Alter the Operating Scale), and to expand the share of the market by investing earlier than competitors (Growth Option).

In addition to these option evaluations, ROA also gives managers a framework to quantify the value of interaction effects in competitive markets. That is, option value would be changed according to competitor's decisions. In other words, option based evaluation could give managers a framework to decide a optimal timing to invest even though the value is affected by expected competitions and continuously changed. This evaluation of interaction from competitors can also be applied to contract problems in construction projects, which are treated as unexpected risks in the international markets such as design changes and changes of natural conditions. They are treated to be the same risks as interactions from competitors who are unexpected to enter into a market.

Moreover, option based evaluation also creates a framework for strategic investment to maximize firm's value by calculating a portfolio value of the valuation of synergy effects of simultaneous projects and interdependence between sequential projects. This method will be discussed in Chapter VI.

The Japanese construction firms in the international market have made their investments into two main categories; labor costs and R&D investments. In the case of the international construction, which has a different character from other manufacturing industry, engineers usually obtain required labors and materials in the local country without taking them from Japan. That's why the object of investment is labor itself and its technological and marketing skills. This tendency is proved from the fact that a majority of fixed assets are consisted of employees. In addition, they also invest in development of human resource, R&D, and M&A with local firms. It is very important to differentiate from their competitors in terms of new technology and construction methods in order to increase contract amounts and profits. That is, managers should make a decision to invest in labor costs, R&D, M&A, and development of human resources, deeply considering option values.

These evaluations are summarized as shown in Figure 5-2.

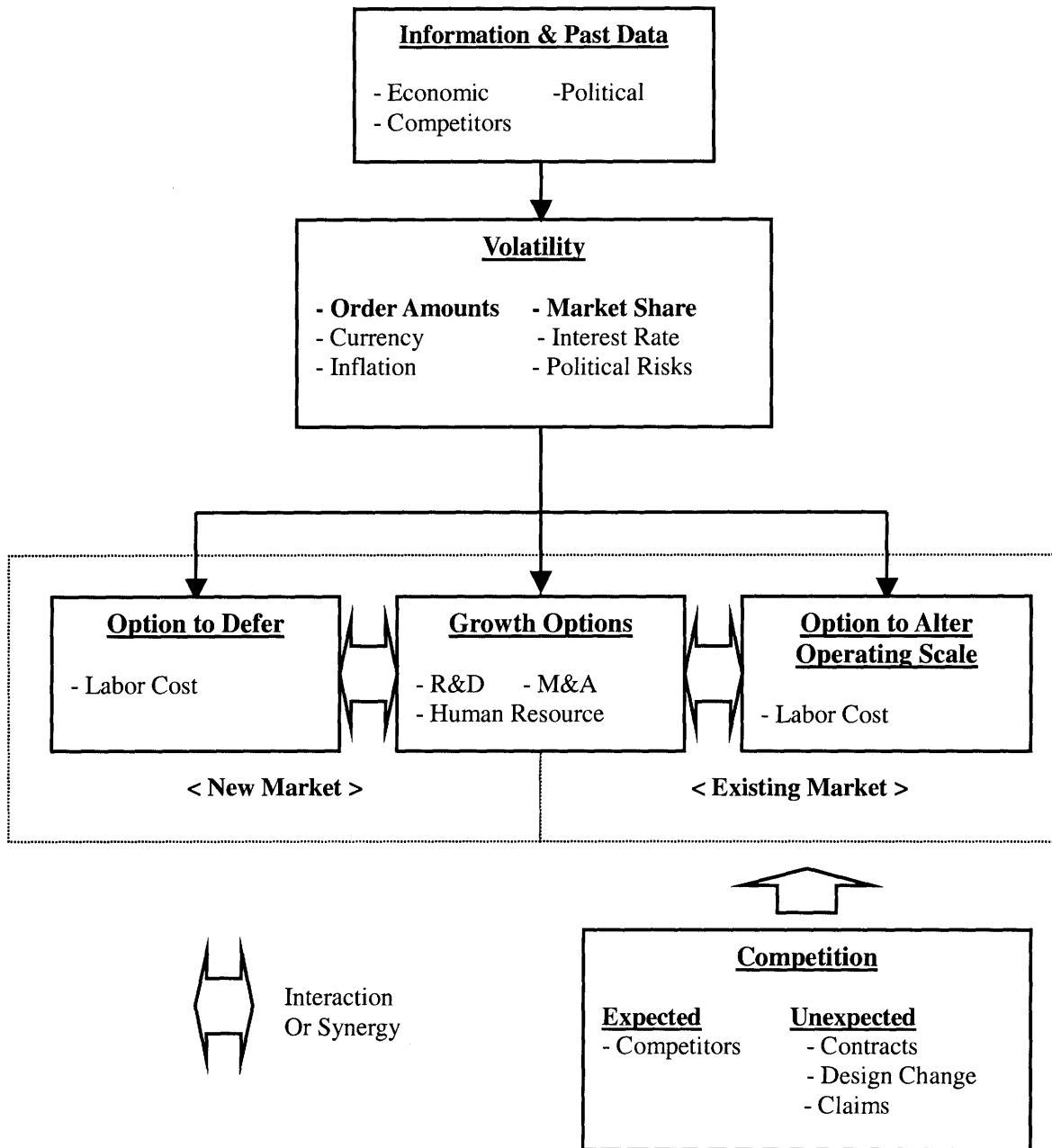


Figure 5-2 Volatility in the International Construction Market

5.3 Real Options in the International Construction Markets

This section examines evaluation of timing and competitions using ROA and also examines option to defer in a new market, option to expand, contract, shut down, or restart in an existing market, and growth option in both markets.

To calculate an option value, volatility of the project should first be analyzed. Figure 5-3 shows the transition of contract amounts in each Asian country. Contract amounts move very differently among countries and its volatilities are also high especially in Singapore. For example, to look at the tendency more in detail, construction types and market shares of the large Japanese construction firms in Singapore are shown in Figure 5-4.

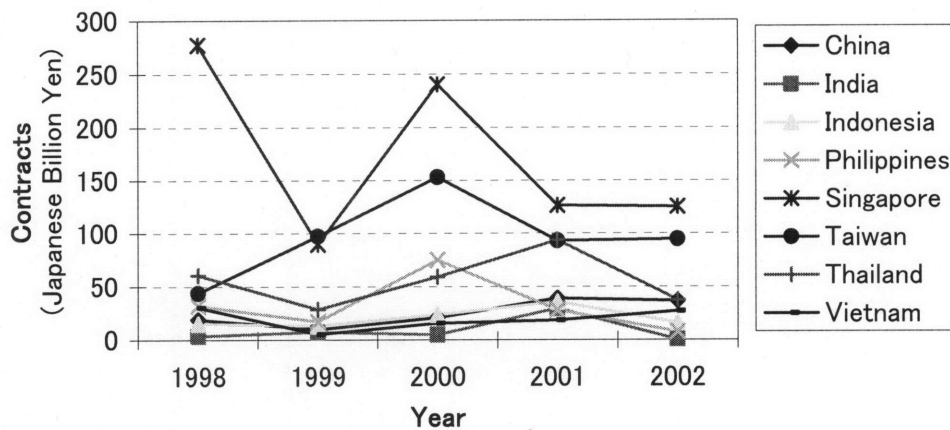


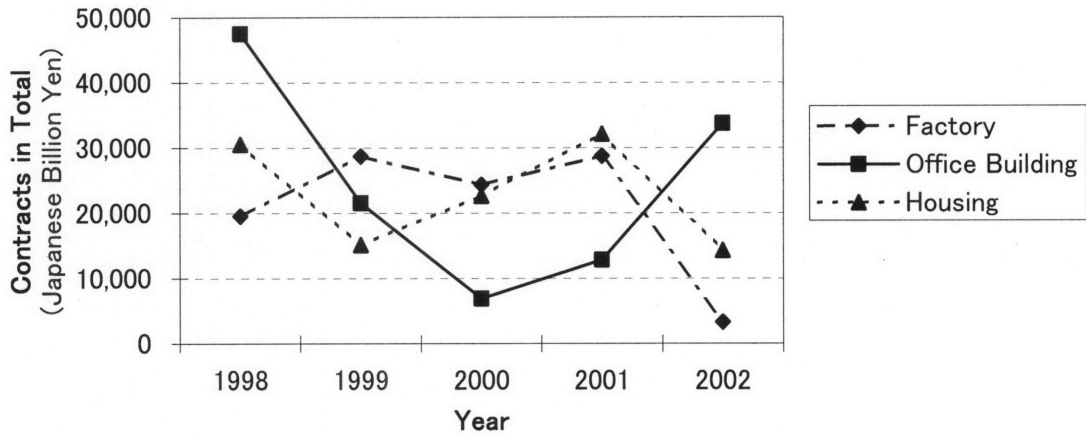
Figure 5-3 Construction Contracts in Asian Countries

Two things are realized from the figures. The first one is that volatility is different between total contracts and those of each construction type. In analyzing a volatility factor, it is important to analyze market scale in detail considering interdependencies for each market scale. The second one is that market share is vulnerable comparing to other industries and in other words, entry barrier of the international market is low as stated in Chapter II. This is important in considering a competition in the existing market.

Volatilities are finally analyzed into a variable using Monte Carlo Simulations. In analyzing them, managers should consider not only the market scale and market share but

also economic and political variables such as currency and inflation.

(a) Construction Type



(b) Market Share

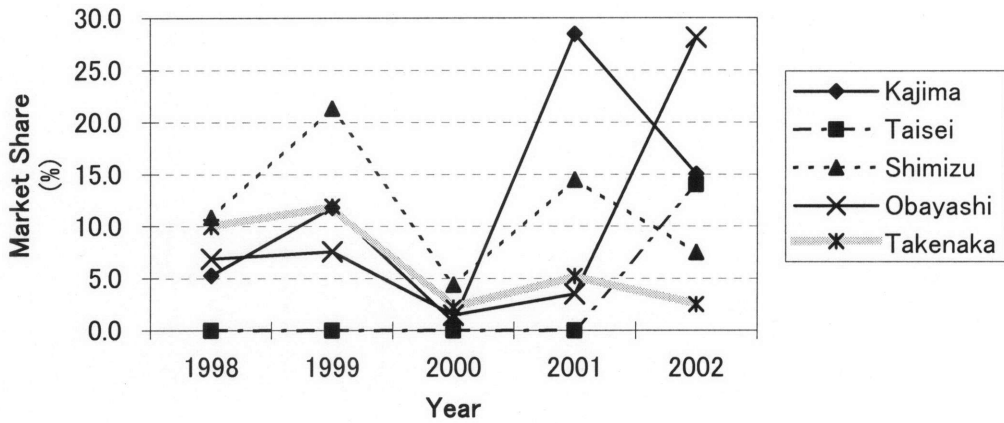


Figure 5-4 Breakdown of Singapore Market

5.3.1 Option to Defer (Entering into a New Market)

Option to defer can be evaluated as American call option whose asset is regarded as NPV calculated from expected cash flow, which is generated from managing a whole project. In this option, the exercise price is the same as a required investment. The investment required as a premium of the basic project is justified and exercised when NPV of the cash flow sufficiently exceeds the investment.

Each construction firm can make a difference with its timing-decisions to invest its assets like labors until it recognizes market situations. As stated in Chapter II and Figure 5-4, there are a lot of volatilities of construction orders and contracts in each country's market. In case of entering into a new market, firms can hold an option to defer because they can wait until they figure out the amount of orders for specific constructions. By deferring, they can make a decision to invest in a specific construction in a growing business condition.

For example in Figure 5-4, Obayashi and Shimizu get contracts from the same construction types in Singapore. That is, office building and Obayashi's market share move almost in the same way, and factory and Shimizu's market share also move in the same way. They should change their strategy by holding an option within Singapore or within Asian countries to make their sales stable in total.

In a country level, in case of shrinking orders of a firm's strong construction type and increasing orders of a firm's weak type, they can increase contracts from weak area keeping contracts from strong area by investing to the country. This leads to increase their total contracts. On the other hand, it is possible not to invest in the country in the opposite business condition. That is, returns from investments are asymmetry by holding options and it is possible to figure out the value of a project with negative NPV even though a project is rejected from the evaluation of DCF method.

5.3.2 Option to Alter Operating Scale; Expand-Contract and Shut down-Restart (Competition in Existing Markets)

Option to alter operating scale is applied when a firm has a right to alter their investment according to business conditions in the existing market. When business conditions are growing and there is a chance to expand its market share, a firm can get more contracts by more investing to labor force for engineering and marketing. This option is considered American call option with which the firm pays an exercise price as an additional investment and get a return to it in addition to the basic project. Moreover, when the market is shrinking, the firm can reduce or stop their investment because the construction industry can do it for the liquidity of their assets. This option is also treated as American put option. In this case, exercise price is the same as planned cost reduction.

In addition to the above two options, there are two options similar to them. Managers do not need to continue to invest into each country through all periods of time. That is, when business condition becomes worse and the firm cannot get enough return to invest, they can choose to shut down their investment. They can also invest after the business condition becomes better. In these cases, the costs of shutting down and restarting the project is considered to be exercise price of call and put options respectively. In the existing Japanese construction market, there is not so many opportunity to shut down their business, so option to shut down is mainly applied in the international markets.

5.3.3 Growth Option; Early Investment to R&D or M&A for Future Growth Opportunity (Existing and New Market)

Growth option is very strategic because it sets a path of a future opportunity to expand a firm's share in the existing market. Growth option in the international construction market is mainly included in R&D for new engineering, M&A with local firms, and development of human resources from inside and outside of the firm. The value of these

investments stems from any opportunity to enter into a new market and expand the share in the existing market. R&D and development of human resources by the early investment lead a firm to a huge advantage for competition in a monopoly market and also lead to strengthen the effect of learning curve and cost curve in the existing market. This option can be treated as American call option.

5.4 Competition

ROA basically evaluates a project value by holding an option and waiting to invest. In a competitive market, however, the existing firm sometimes loses their value because competitors would enter into the market while the firm defers to invest. If the firm can avoid the risk of losing their value by making an early investment, the firm needs to face a trade-off between the value created by options and the competitive loss.

In the international market a firm has already been existed, managers should examine how they can avoid losing their share and expand it, recognizing when they should exercise their options such as option to alter operating scale or Growth option, in case that a competitor enters into the market at an expected time. Moreover, in terms of unexpected design changes and changes of natural conditions during the construction period, these problems in contracts are treated as unexpected competitor's appearance. These evaluations are examined in this section.

5.4.1 Expected Competition

a. Market Competition (Avoid Entering into a New Market)

Investment opportunities examined by options usually stem from the business resources which have been established for a long time, including technical knowledge, reputation, position in the market, and the firm's scale of the business. From such resources, a firm can invest productively to a specific project which competitors cannot execute. Even in case that the firm cannot avoid losing resources by the expected competition, these resources cannot easily be traded to other firms. From this reason, to avoid losing from the expected competition, it is usually the most efficient way not to make competitors enter into the market. This section focuses on avoiding a competitor entering into the existing market.

The optimal timing and character of decision-making for exercising options can be analyzed using call options with dividend. Financial option and real option are similar in terms of the followings.

Table 5-2 Comparison between Financial and Real Options

Items	Financial Option	Real Option
Time t_1, t_2 ($0 < t_1 < t_2 < T$)	Ex-dividend	Entering into the Market
Value of Option R	Dividend	Loss caused by a competitor

To make this problem simple, suppose that there are two firms entering into the market at time of t_1 and t_2 . The value of the project is calculated as follows.

$$\begin{aligned} \text{In Case of Entering at } t_1 & R_{t_1} = C(V', t_1, I') \\ \text{In Case of Entering at } t_2 & R_{t_2} = C(V', t_2, I'') \\ \text{In Case of Entering at } T & R_T = C(V', T, I) \end{aligned}$$

where, T : Project Period
 t_1, t_2 : Timing of entering into a market
 C : Option Value calculated from Black-Scholes Formula
 V : Total Value of Project
 V' : Value of Loss for Dividend
 I, I', I'' : Present Values of Required Investments to Get Project V and V'

The existing firm should choose the timing to invest as $R = \max(R_{t_1}, R_{t_2}, R_T)$. The bigger the expected loss of project value is, which is avoidable from competition, the smaller the value of waiting is. It can also say the same thing, when competitors are entering more fluently.

Here lists the reason for early investments.

- Loss of competition could be sufficiently avoided.
- Competitors are expected to enter frequently.
- Uncertainty of a project is little.
- Avoidable competition loss would excess option value given up for early investment.

Because of low entering barrier in the international construction market, competitors frequently enter into a relatively easy construction market and existing firms tend to early exercise their options. On the other hand, in the specific construction market, they tend to hold their option and apply options efficiently. In Figure 5-4, for example, Taisei Corporation can easily enter into Singapore market by getting a contract of easy road construction in 2002, even though they had not done any construction in Singapore for more than 4 years.

b. Competition to Expand a Market Share (Strategic Investment for R&D and Development of Human Resources)

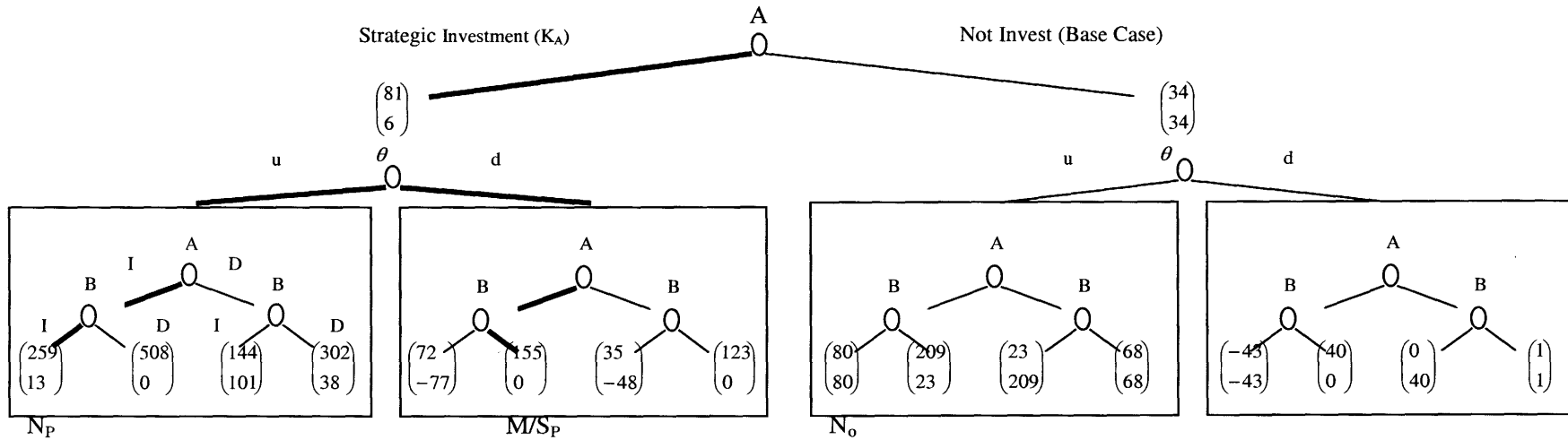
The Strategic investment, such as R&D, Development of human resources, and M&A with local firms, should be taken, correctly understanding information about competitor’s strategy and volatility of construction orders in the market against the firm’s optimal performances to invest. Trigeorgis (1996) made a real option analysis in terms of different competition strategies between proprietary and shared investments, using industry organization theory and game theory. Figure 5-5 is R&D example showing investment strategies of Firm A under change of orders in the market and under competitions with Firm B. The numbers in the Figure is calculated from the following assumptions.

- First-strategic investment by pioneer firm A: $K_A = 110$**
 - Follow-up (second-stage) investment outlay by either firm A or B: $I_A = I_B = I = 100$**
 - Initial demand parameter: $\theta_0=14$ (with $\theta_1 = u\theta_0$ or $d\theta_0$)**
 - Binomial up and down demand parameters: $u = 1.25, d = 1/u = 0.80$**
 - Risk-free interest rate: $r = 0.10$**
 - Risk-adjusted discount rate: $k = 0.13$**
- | | | |
|------------------------|-------|-------|
| Operating Costs | C_A | C_B |
| | 3 | 3 |
| | 0 | 3 |
| | 0 | 0 |

As a result of Figure 5-5, Firm A should take a optimal strategy that they should invest early in case that they could eventually get the proprietary profit, and that they should hold a flexible option in case that they would share the profit of the investment. If Firm B would take a reciprocating strategy, however, Firm A sometimes needs to avoid early strategic investment because both Firm A and B would lose their profits.

Like in the Japanese traditional market, Firm A and B usually take a strategy to share and increase their profits. In such a case, Firm A should make an early strategic investment.

(a) Proprietary Investment (Positive Strategic Effect)



(b) Shared Investment (Negative Strategic Effect)

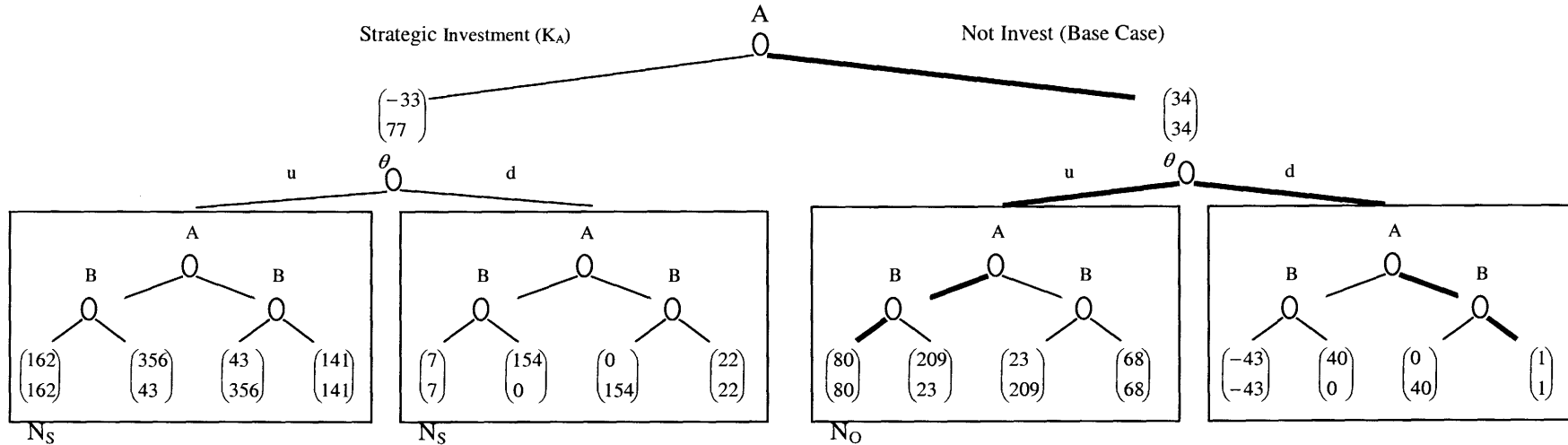


Figure 5-5 Competitive Strategies in the Investment for R&D, M&A, and Human Resources
 (Source: Trigeorgis (1996))

5.4.2 Unexpected Competition (Contract Problems)

Unexpected situations on the contract such as design changes and changes in natural conditions could be treated as unexpected competitors entering into the existing market. This is quantified by being treated as ex-dividend options. Trigeorgis (1996) calculated the loss of existing firms when timing of competitors to enter into the market cannot be recognized. In case of unexpected competitors, loss of the existing firms is calculated as the weighed average of Black-Scholes values which have sequential dividends. In other words, random appearance of competitors makes existing firms pay cash flow of the project and sequential dividends. In this case, the amount of dividends depends on the strength of the competition and parameter of market structures. The dividends will become the total loss of the existing firm who owns an option.

CHAPTER VI

MAXIMIZING FIRM'S VALUE

6.1 Overview of Maximization

Evaluation methods of valuing a firm in the US are based on creating a shareholder's value and making its stock price go up. The first reason for this method is that shareholders directly affects the management of a firm, and the second is that the system of creating it leads to better results than other systems and there is nothing lost of other shareholders' profits. As shown in Chapter II, the difference of ROIC between the US and Japan should be considered because this has primarily lead to the current recession in Japan. Recently in Japan, these methods have drawn the attention of managers because stock prices have been going down since the collapse of the bubble economy.

There are a lot of Japanese construction firms whose debt to equity ratios are very high and over 5.0, and whose stock prices are under the cost basis of 50 Japanese Yen. This is due to the fact that managers have not paid much attention to shareholder's value and simply financed from their main banks. Because shareholders invest in a firm considering its future performances, stock prices completely depend on the difference between their expectations of future performances and the firm's actual accomplishments.

For this reason, in order to optimize their capital structure and to reduce their debt, they need to adopt a strategy to efficiently maximize the firm's value. That is, they need to take into consideration the long-term cash flows of their projects and also pay attention to whether the investments make a return on cash flow above their cost of capital. Also, they need to choose a strategy to maximize their value by calculating NPV using an adequate discount rate or using ROA.

As shown in Chapter IV, although valuation of a firm is made by DCF method, there has been no valuation of flexibility of a manager's decisions. This means that maximizing a firm's valuation is decided by simply adding NPV of each project and managers have used this method.

However, as shown in Chapter V, managers can increase values for their firms by creating and holding their options in decision-making. Considering synergy effects of simultaneous projects, interdependence between sequential projects, and interactions in competitive markets, managers need to make their decisions continuously analyzing total values for their firm. It has recently been possible to make these valuations by applying ROA.

In addition to valuation of projects in the existing market in Japan, this Chapter examines strategic investment planning and control objectives as indices of maximizing a firm's value using ROA both in the new market in Japan and in the international market.

6.2 ROA Quantification of Project Interactions

Managers should effectively invest in projects using their assets because labors and equipment of the firm in the international market are limited. In other words, they need to evaluate the projects in terms of a strategic value, considering synergy effects of simultaneous projects, interdependence between sequential projects, and interactions in competitive markets. Although these effects between projects are difficult to measure using DCF methods, ROA helps managers evaluate them effectively.

The following section explains these effects, except for interactions in competitive markets, which are discussed in Chapter V.

6.2.1 Synergy Effects of Simultaneous Projects

It is common to separately evaluate values of internal and external projects by DCF method. Internal projects refer to those that managers invest in to improve productivity and reduce costs. On the other hand, external projects refer to those in which they invest marketing and M&A to expand their market. If NPV of each project is negative, these projects are rejected. However, these values are evaluated simultaneously using ROA, and there are many opportunities to create an overall positive value. Trigeorgis (1996) established a modeling for this evaluation as follows.

$$\max_{d_E, d_C \in \{0,1\}} V' = S' - C' - (d_E I_E + d_C I_C)$$

$$S' = \begin{cases} S & (d_E = 0) \\ (1+e)S & (d_E = 1) \end{cases}, \quad C' = \begin{cases} \alpha S' & (d_C = 0) \\ \alpha(1+c)S' & (d_C = 1) \end{cases}$$

or

$$\max_{d_E, d_C \in \{0,1\}} V' = (1 + ed_E)S[1 - \alpha(1-c)d_C] - (d_E I_E + d_C I_C)$$

where, **e** : Effects on External Investment
c : Effects on Internal Investment
I_E : External Investment
I_C : Internal Investment
S : Sales
C : Cost
V : Net Cash Flow
S', C', V' : Sales, Cost, Net Cash Flow after synergy effects
 α : Ratio between Cost and Sales

For example, there are investment opportunities of increasing labors for expansion of market and of developing a research for cost reduction. In this case, each project has a negative value, however if managers invest them simultaneously, there is a possibility that the mixed project have a positive value as a whole.

This means that managers should consider an important network between a feedback of external situation for their market and an interdependence of internal investment to create cash flows.

6.2.2 Interdependence between Sequential Projects

Because strategic projects such as entering into a new market and developing R&D make sequential projects more valuable, the strategic projects would be more valuable than other general projects. This is considered to be Growth Option and the value of the project becomes higher in high-volatility market. That is, the higher volatility in the market becomes, the more variable a project is. So, not in the Japanese market but in the international market, it is more important to understand the interdependences between projects in the long run.

Even if the first strategic project has a negative value, it is possible for the sequential project to have a positive value. The first project, although it has a negative value, is

selected considering a total value of both projects. Construction contracts in the international market comes from the business resources which have been established for a long time, including technical knowledge, reputation, position in the market, and the firm's scale of the business. From this reason, there are many opportunities to invest in advance considering these effects. However, in the international construction market, this strategy is usually useful for high-engineering projects and not for low-technical projects. The market for low-technical projects has low entry-barrier and competitors frequently enter into the market as stated in the example of Taisei Corporation in Singapore. Managers should pay much attention to market situations for these strategic investments.

6.3 Strategy for Maximizing Firm's Value

It is not simple to establish a strategy for maximizing a firm's value in a single way. Managers should continuously improve their strategy according to changes of market situations. Through chapters in this research, the process of establishing a strategy is stated and it can be summarized as in Figure 6-1.

First, managers should analyze business situations outside the firm, such as change of orders and economic and political environments. At the same time, they should understand situations inside the firm, such as financial environment, R&D, and organizations. Then they can use DCF method for quantifying projects in the Japanese Market because they have a lot of historical data for them and there is not uncertainty of projects. Also, they can use ROA for quantifying strategic projects with uncertainty in a new market in Japan or in the international market because they have a high volatility for their risks. Moreover, in using ROA for strategic projects, they should simultaneously consider mutual interactions between projects.

Next, they concretely establish their control objectives based on financial indexes like ROIC and growth rate. The process should include the firm's short and long-term goals. By doing so, they can easily recognize optimum strategies in accounting scales for choosing projects and maximizing the firm's value.

During these processes of managing projects, they should check whether the project matches their first goals and whether they should change their organization to make more value, and so on. They continuously revise and improve their strategies to maximize their firm's value according to their market changes.

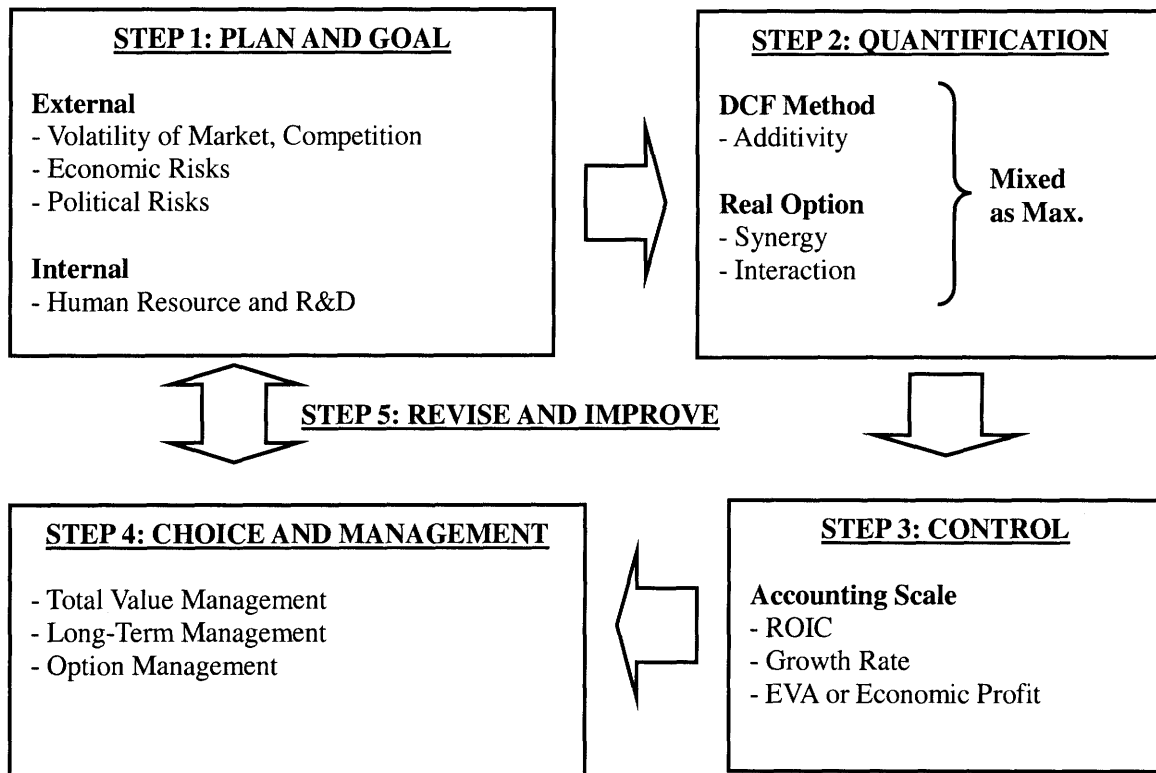


Figure 6-1 Strategy of Maximizing Firm's Value

6.3.1 Planning and Goal

To develop a strategy for maximizing a firm's value, managers first need to keep up on situations outside and inside of their firm. As an outside situation, they need to understand the firm's market share and construction orders in each market segment from current and estimated points of view. As an inside situation, they also need to understand how much and how performance has been accomplished, and how much it will perform in the future. It is also important to catch their incentive scheme and firm's organization based on it.

In the shrinking market of the Japanese construction industry, managers need to set a goal based on their strategies, which are entering into a new market in Japan and in the international market, or expanding their market shares in the existing markets.

6.3.2 Quantification

In DCF method, which can be applied for projects in certainty markets, each project is considered to be independent and each NPV can be added. From this reason, if each project has a positive NPV, managers have taken a strategy to accept these projects considering their limited assets because they make firm's value higher as a whole. This comes from the reason that NPV has a character of additivity. In a large-volatility market, however, valuation needs to be analyzed using ROA and the value of the project should be quantified precisely. ROA can efficiently evaluate the volatility and uncertainty of the project.

After quantifying the value of the project, managers need to decide which projects make firm's value maximum as a portfolio value from long-term points of view. This decision should be made considering synergy effects of simultaneous projects, interdependence between sequential projects, and interactions in competitive markets as stated in Chapter V and VI.

6.3.3 Control Objectives

Control objectives should be decided from the perspectives of long-term and total outlook for their value. In that case, outputs from each project may not be their maximums. However, considering total outputs to be a maximum, managers need to connect capital planning, incentive scheme, and control objectives, with observable accounting scales such as ROIC, growth rate, and EVA.

There is no royal road to make an complete index for a corporate strategy, but it is important to make goals for these accounting scales because they directly affect the value of the firm.

6.3.4 Choice and Management

Projects are selected from perspectives of long-term and total outlook for their values, based on the control objectives. This is obvious from the fact that managers need to examine a portfolio value of the firm.

Moreover, managers should continuously examine when to exercise their own options and where an opportunity to make a new option still exists, and should decide strategies to respond to their rapid market changes. In case of a large-volatility market, the strategy should be revised adjusting to control objectives and goals as needed.

CHAPTER VII

CONCLUSION

Real option analysis (or ROA) gives managers of the Japanese construction firms a comprehensive perspective to evaluate uncertainty of projects in the international market. For projects in the Japanese market, however, Discounted Cash Flow (or DCF) method is useful to evaluate projects because there are a lot of historical data and information about the projects. ROA also gives managers a portfolio value of each project and a strategy to maximize their firm's value, considering synergy effects of simultaneous projects, interdependence between sequential projects, and interactions of competitors in the existing market.

This research has been arguing the important points as the following scenario.

1. The Japanese construction market and a firm's financial problems

To cope with the current situation of the Japanese construction market, in which construction investments have been going down since the collapse of the bubble economy, managers should increase ROIC or growth rate to improve their firm's value. A strategy to improve growth rate is to expand their market overseas. In that case, the Japanese unique business custom such as contracts and organizations possibly becomes a barrier for it although their high-tech engineering becomes a competitive advantage.

2. Japanese construction firms in the international market

The Japanese large-scale construction firms have not actively expanded their business in the international market comparing to other foreign firms. By analyzing contract amounts in each market including Asia, US, and EU, the amounts basically depend on the global economic environment. By looking at each country level or project type level more in

detail, however, managers can efficiently evaluate difference of volatility in order amounts and take a strategy to expand their sales. Managers should also look at other volatilities of expected economic and political risks such as interest rate, currency, and political risks, and also look at unexpected risk such as contract problems including changes in natural conditions.

3. DCF method

DCF method can be used to evaluate certainty projects and firms in the Japanese market. DCF method starts analyzing financial statements because of its characteristics of additivity. EVA or Economic profit gives managers a framework to evaluate project's or firm's performance because it focuses on invested capital and its return for a project. However, DCF method has some disadvantages in calculating WACC and forecasting future cash flows.

4. ROA

ROA can be applied to uncertainty projects in the international market because it can evaluate and quantify flexibility of manager's decision making according to changes of the market situations. In analyzing volatility of risks, managers should focus mainly on market scales and shares in detail because they give managers strategic decision-making information to apply three types of options; option to defer, to alter change scale, and growth option. The international construction market has low entry barrier, so to analyze competition is also important. ROA also gives a framework to analyze both expected and unexpected competitions. Moreover, this analysis eventually gives managers useful indexes for maximizing their firm's value.

5. Maximization of firm's value

In DCF method, NPV has characteristics of additivity and value of a firm is calculated by simply adding NPV for all projects. On the other hand, in ROA, managers should consider a portfolio value of each project as a whole firm's value because ROA can

evaluate interactions of each project and it is possible to make negative NPV project valuable. In other words, managers should consider total value of the firm and total investment amounts in maximizing the firm's value. In addition, managers should set strategic investment planning and control objectives as indexes of maximizing a firm's value using financial indexes, such as ROIC, growth rate, and EVA. The maximization strategy consists of continuous processes, so managers should revise and improve it as market situation changes.

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