Master of Science

Developing an Assessment Model for Risky Unclaimed Invoices of Korean Construction Firms Using Information Disclosure

August 2016

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Abstract

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Financial difficulties relating to projects, such as huge losses and unclaimed invoices, have been identified as a problem for the construction industry. Especially, unclaimed invoices that have been incurred but have not yet been recognized by the customer are a particular financial issue in the Korean construction industry. And the sum of unclaimed invoices has been on an increasing trend in Korean top construction companies and large amounts of unclaimed invoices have a high probability of translating into a loss.

Despite the riskiness of unclaimed invoices, information about them is

protected by firms as being ‘inside information’. As such, investors and other stakeholders have difficulties interpreting this information. There are also no systems or assessment standards related to unclaimed invoices or the risks. Moreover, there are many studies on predicting bankruptcy or assessing business performance but few focus on unclaimed invoices. Due to these reasons, the unrevealed large amounts of unclaimed invoices, which can’t be immediately recovered, can cause companies to suffer from financial strains and are directly connected with investor losses.

In general, all unclaimed invoices are considered dangerous; however, there are certainly some unclaimed invoices that can be recovered without any losses. As such, it is necessary to distinguish bad unclaimed invoices from the total number of unclaimed invoices. So this study suggests guidelines for comparing firms based on the unclaimed invoices.

As the result of literature review, there are some limitations. Under current accounting basis, the major weakness is that there isn’t a standardized technique for assessing the percentage of completion of a project. As such, there will be a gap between the real percentage of completion and that reflected in the accounting. This characteristic of an unclaimed invoice can be occurred losses. To solve this problem, this study analyzed the difference in unclaimed invoices between negative profit groups and positive profit groups. Secondly, variables that affect unclaimed invoices were identified from the whole data set. Next, the whole data were divided companies into 2 groups; sound performance group and performance deterioration group. The performance deterioration group was also analyzed to identify the variables that affect unclaimed invoices. The causes of unclaimed invoices that have a

high possibility of being a loss were analyzed by comparing these two results from the whole data and the performance deterioration data. Lastly, using these results, formulas used to calculate the dangerous of unclaimed invoices were created and classification standards were set. Twenty percent of the whole data were used in the validation process, and verification was conducted using expert interviews.

As the result, unclaimed invoice that two years before occurring losses has significant value by conducting t-test. Next performance deterioration group was divided into 3 groups; large sales group, mid-sized sales group and small-sized sales group. By conducting regression analysis, significant variables that affect unclaimed invoice were identified. For the large sales group uncovered three significant variables: domestic sales, infrastructure sales and receivables turnover. In mid-sized group, there was a significance difference in the total sum of plant sales and construction sales. Lastly, in the small-sized group both the proportion of infrastructure sales and receivables turnover were selected as significant variables. Using these factors and coefficient values, formulas that assess risk level of unclaimed invoice were defined. All the result was classified into high level of dangerous, considerable level and moderate level.

Since information surrounding unclaimed invoices are available to the public, this study reveals the risk associated with excessive amounts of unclaimed invoices and aids transparency in company accounts. It will contribute to reducing the adverse selection of stakeholders as a result of information asymmetry and help them to accurately assess a company's performance. Ultimately, it will help increase the financial health of Korea's

construction industry, as well as the efficiency of the market.

Although this study has contributed to this field of research by conducting an empirical study of unclaimed invoices using real data, it didn't consider comprehensive situations of certain company's situations such as experts' insight. This research conducted an investigation into the unclaimed invoices of enterprise units. There was a limitation in the detailed analysis because the total amount of unclaimed invoices was used as the dependent variable. However, an in-depth analysis of the markets and the projects which cause unclaimed invoices could be undertaken if research can be conducted based on information related to specific markets and newly disclosed projects.

Keywords: Unclaimed invoice, Construction accounting, Percentage of completion basis

Student Number: 2014-22710

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Chapter 1. Introduction

1.1 Research Background

Financial issues relating to projects, such as huge losses and low profit rates, have been identified as a problem for the construction industry. With the increasing volatility and complexity of the construction market, many domestic companies fail to satisfactorily deal with risk (Eybpoosh and Talat, 2011). As a consequence, financial issues have been directly connected with losses and many domestic construction companies have suffered financial difficulties.

Firstly, along with these financial issues, construction companies have continuously recorded earning shocks and drops in operating profit. According to the accounting reports of three of the five Korean companies that were listed on the top of the ENR (Engineering News Records) ranking in 2015 (ENR top 250 International Contractors) the firms have experienced a continued slide in profits and stock prices over the past 5 years (ENR, 2015), eventually tumbling into the red around 2013 as in Figure 1.1. An earning shock also occurred; it was reported that a certain Korean construction company in Figure 1.1 recorded ₩9.2895 trillion in sales and ₩160.3 billion in operating profits in the first quarter, but in the second quarter its sales dropped to ₩1.7085 trillion and the operating loss significantly jumped to

₩3.399 trillion. The stock price of this company was ₩51,136 before the announcement, dropping sharply to ₩26,724 after the announcement as shown in Figure 1.2. No one – even analysts – predicted such considerable losses. The results shocked the market.

Figure 1.1 Decreasing Profit of Korean Construction Company[1]

1 Source: Operating profit and revenue accounts in the financial statements of A, B and C company from 2010 to 2014.

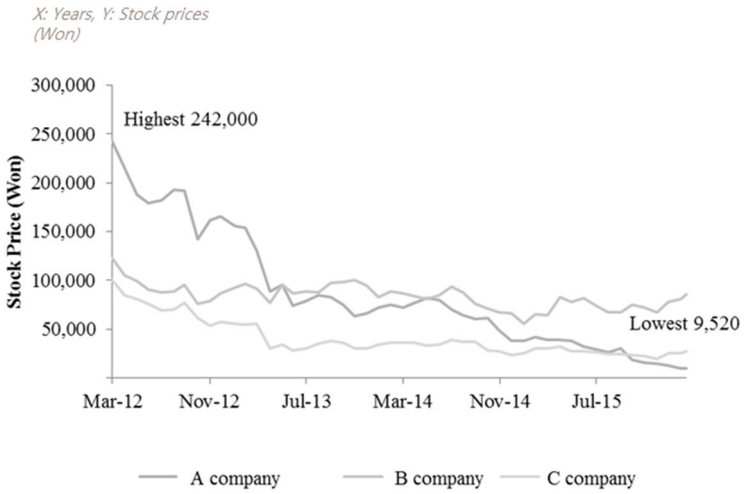

Figure 1.2 Decreasing Stock price of Korean Construction Company[2]

Secondly, unclaimed invoices (미청구공사) are a particular financial issue in the Korean construction industry. The definition of an unclaimed invoice is an amount that correspond to costs that have been incurred but have not yet been recognized by the customer (Lee Y. S., 1999). The sum of unclaimed invoices has been on an increasing trend in Korean top construction companies over the past 5 years as shown in Figure 1.3.

2 Sources: Stock prices from each company's financial statement using the Kisvalue program.

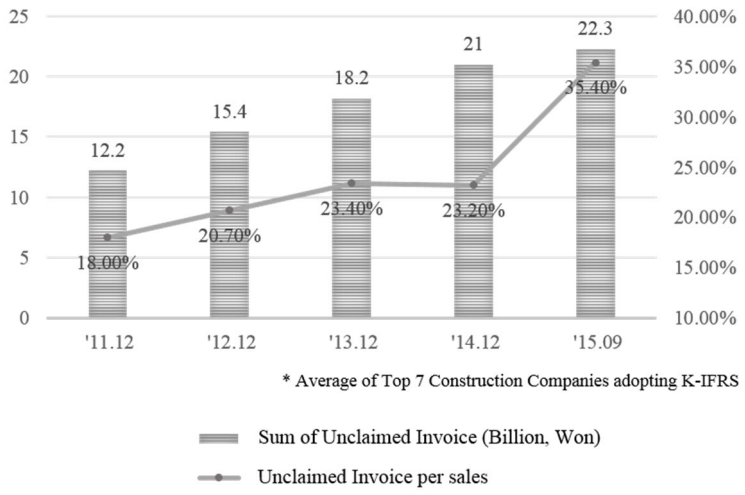

Figure 1.3 Increasing Unclaimed Invoices of Korean Construction Company[3]

Unclaimed invoices are highlighted as the reason for the 'sudden' losses noted earlier (Kim C. H., 2016; Kim K. H. et al., 2015, Ryu J. H. 2015). As is well known, the primary causes of a continuous fall in operating profits are a lack of competitive power and low-price booking (LGERI, 2001). But such sudden losses do not occur as a result of these factors alone. Many investment and accounting experts state that such serious sudden losses are caused by

3 On the list of 'Assessing construction capability of construction firms' (conducted annually by the Construction Association of Korea (대한건설협회 시공능력평가), construction companies in the upper ranks were selected to check the tendency towards unclaimed invoices. Comparing the amount of those in the fourth quarter of 2011 it increased to double. Data were collected from each company's financial statements from 2011 to 2015.

unclaimed invoices (Kim C. H., 2016; Kim K. H. et al., 2015, Ryu J. H. 2015).

Mounting unclaimed invoices are dangerous for companies. Firstly, increases in unclaimed invoices can be connected to increases in construction costs and allowances for bad debts in the financial statement so that they need careful management (Lee W. S., 2015). Secondly, an unclaimed invoice is a type of expenses which is incurred but not yet confirmed by the customer, as mentioned above. As such, there are no guarantees to when a contractor will receive payment. If a company fails to collect payment, the amount of the unclaimed invoice is recognized as an expense; unclaimed invoices will therefore result in sudden losses (Kim K. H. et al., 2015), which in turn can lead to stock price plunges. Thirdly, not collecting on these accumulating unclaimed invoices can result in a negative cash flow, even though the company makes a profit. As a result, companies can experience financial strain. For these reasons, an excessive amount of unclaimed invoices can be considered a risk. However, in the Korean construction industry the sum of unclaimed invoices has been on an increasing trend. In summary, the number of unclaimed invoices that have a high probability of resulting in financial loss is getting higher and riskier in Korea's construction industry.

1.2 Problem Statement

Large amounts of unclaimed invoices have a high probability of translating into a loss. Despite the riskiness of unclaimed invoices,

information about them is protected by firms as being ‘inside information’. As such, investors and other stakeholders have difficulties interpreting this information. As detailed information about unclaimed invoices are not announced, various situations can cause an increase in unclaimed invoices. There are also no systems or assessment standards related to unclaimed invoices or the risks. Moreover, there are many studies on predicting bankruptcy or assessing business performance but few focus on unclaimed invoices.

Due to these reasons, stakeholders can make adverse selections as a result of information asymmetry. For customers, for example, it is impossible to accurately assess a company’s performance. In the long term, if sudden losses repeat, not only does it harm investors, it also damages the efficiency of capital markets. In summary, the unrevealed large amounts of unclaimed invoices, which can’t be immediately recovered, can cause companies to suffer from financial strains and are directly connected with investor losses.

As a result, in general, all unclaimed invoices are considered dangerous; however, there are certainly some unclaimed invoices that can be recovered without any losses. As such, it is necessary to distinguish bad unclaimed invoices from the total number of unclaimed invoices. This study suggests guidelines for comparing firms based on the different types of unclaimed invoice.

1.3 Research Objectives

The primary objective of this study is to analyze the causes and impact of an excessive unclaimed invoice and to provide key determinants for evaluating unclaimed invoices in the construction industry from an accounting perspective. As detailed information about unclaimed invoices is unpublished, this study reveals the riskiness of excessive amounts of unclaimed invoices and aids transparency in company accounts. Ultimately, it helps increase the financial health of the construction industry and market efficiency.

The specific objectives to achieve the primary objective are as follows:

1. Discover a link between loss and unclaimed invoices.
2. Investigate causes of unclaimed invoices through the empirical study and investigate what makes the financial amount of unclaimed invoices increase excessively in a company's financial statements.
3. Classify the risk level of each company's unclaimed invoices.

This research is for all construction company stakeholders; for investors, banks, customers and other stakeholders, it helps that they can rightly appreciate companies. Uncovering the risk associated with unclaimed invoices, which is hidden information, prevents stakeholders from making adverse selections caused by information asymmetry. Eventually it will also help the construction industry to have a sound and fair market.

1.4 Research Process

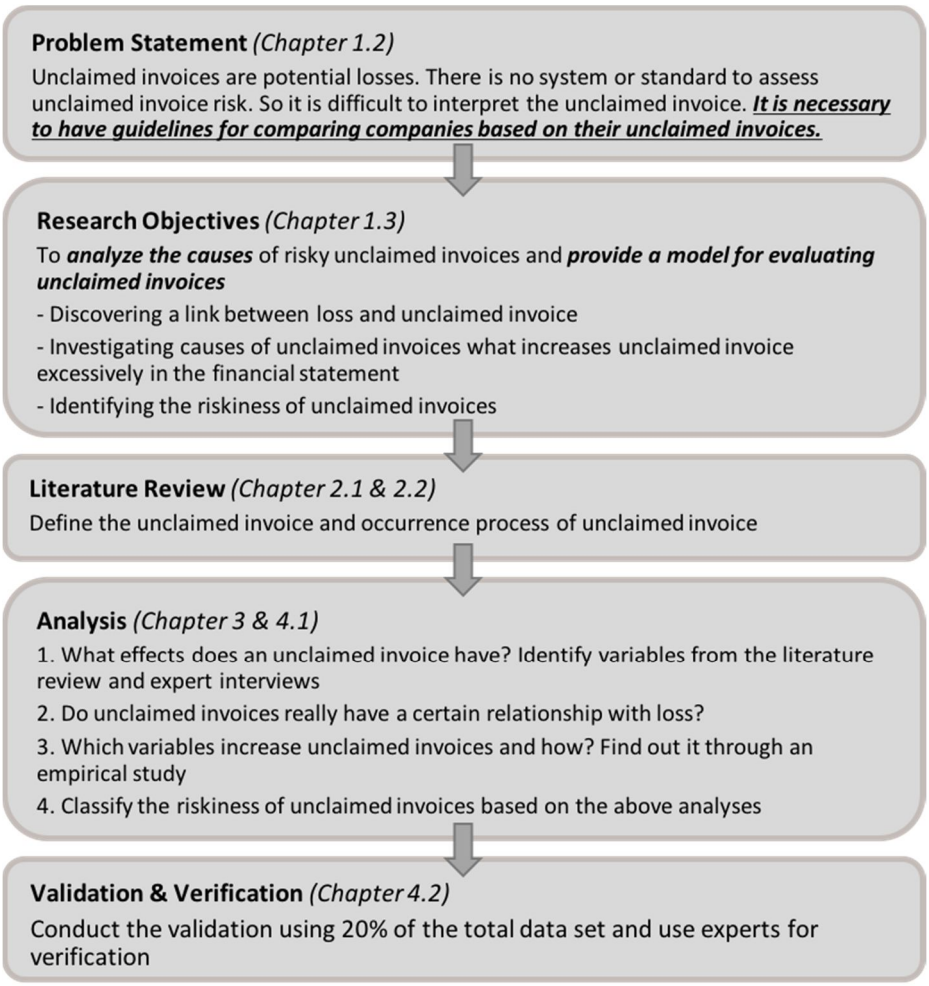

Figure 1.4 Research Flowchart

This study was conducted using a literature review, interviewing experts, identifying theories using real data and making a model. The research process is as follows. First of all, the theory behind unclaimed invoices was

researched by conducting a literature review of books and reports. Secondly, the current state of the issue of unclaimed invoices was investigated using financial data from a financial supervisory service (금융감독원) and research from credit rating agencies (Korea investors service: 한국신용평가, NICE investors service: 나이스 신용평가, Korea ratings: 한국기업평가). Thirdly, an empirical study on the causes of unclaimed invoices was performed so that theory and experts' opinions could be verified. Following this, the riskiness of a company's unclaimed invoices was assessed. These are divided into the following three steps: 1. identifying the relationship between unclaimed invoices and losses – statistical analysis of unclaimed invoices that really affect losses and how long it takes for these losses to be reflected; 2. identifying factors which are the causes of unclaimed invoices from an accounting perspective – statistical analysis of factors that affect unclaimed invoices and how much each factor affects unclaimed invoices by different revenue levels; and 3. assessing the retention level of unclaimed invoices classified by company features using the results of step 2 to work out the degree of risk.

Chapter 2. Literature Review

2.1 Unclaimed Invoices

2.1.1 Definition of an Unclaimed Invoice

An unclaimed invoice is also called an 'amount due from customers'. It is referred to in IAS 11 (International Accounting Standard): "A contractor may have incurred contract costs that relate to future activity on the contract. Such contract costs are recognized as an asset provided it is probable that they will be recovered. Such costs represent an amount due from the customer and are often classified as contract work in progress." In other words, the definition of an unclaimed invoice is the amount of revenue earned on a contract that has not been billed. Thus, an unclaimed invoice account comprises the amount of money that is supposed to be paid by customer, but that a contractor cannot yet demand. If a contractor conducts the project properly the customer will agree on the unclaimed invoice and the amount will be redeemed. This happens because production-to-order industries have the unique characteristic of having different ways to collect money in accounting perspectives.

2.1.2 Accounting Principles of the Construction Industry

(1) Generally accepted accounting principles: Accrual basis accounting.

In the real world, people record revenue when they receive cash and record expenses when they pay out cash. This is referred to as 'cash basis accounting', but it is not in accordance with generally accepted accounting principles (Kimmel et al., 2010). Typically, a company's revenues and expenses are recognized by the accrual basis principle. Under accrual basis accounting, revenue is recognized when a company actually sells a service and recognizes expenses in the period when the firm recognizes the revenue that the costs helped produce, irrespective of cash flows as described in Figure 2.1. Thus, the most important part of accrual accounting is matching expenses with associated revenues (Stickney et al., 2009).

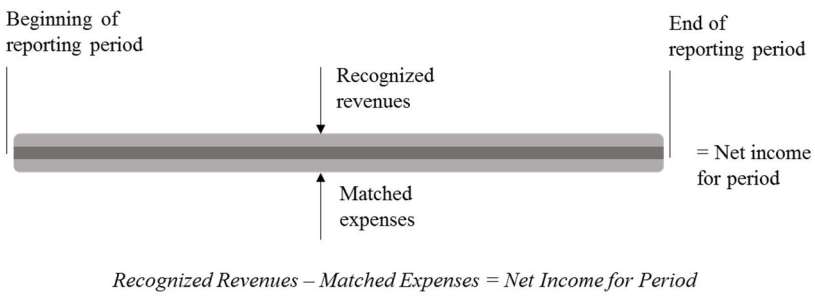

Figure 2.1 Determining Accrual Income (Albrecht et al., 2010)

Assume that 'D company' billed a customer $50,000 for services performed in 2015. D company received $10,000 in cash from the customer, who will pay the balance in 2016. During 2015 D company paid $20,000 for expenses that had been incurred. At the end of 2015, D company spent $15,000 more for additional expenses incurred and the company postponed

expenditure until 2016. In this scenario, the cash basis of accounting recognized only $10,000 in revenue during 2015, even though they had made a deal value of $50,000. Likewise, the company would report only $20,000 of expenses during 2015. The additional $15,000 of expenses incurred but not yet paid would not be reported. Using accrual basis accounting, however, D company would report $50,000 worth of revenue, which is the total increase in resources for the period. Similarly, D company incurred a total of $35,000 in expenses, which should be matched with revenues earned to produce a realistic income measurement, as Figure 2.1 shows. If the company incurred the expense of a tangible asset, such as a machine, it would recognize the depreciation expense at the moment when the revenue is recognized. The principle of the accrual basis will guide accounting evaluation to include this order as part of the current year's performance even though the collection of money will happen the following year, so that the manager's performance will be fairly appraised. In summary, accrual basis accounting matches earned revenues with the expenses incurred to generate those revenues. By making financial statements based on the accrual basis it is possible to more accurately recognize a company's profitability. This helps investors, creditors and other stakeholders to better assess a company's operating results and make more informed judgements concerning its profitability and earnings potential (Albrecht et al., 2010).

Table 2.1 Comparing Cash Basis Accounting and Accrual Basis Accounting

A company Reported Income for 2015			
Cash Basis Accounting		Accrual Basis Accounting	
Cash receipts	$10,000	Revenues earned	$50,000
Cash disbursements	20,000	Expenses incurred	35,000
Income	($10,000)	Income	$15,000

(2) Accounting principles for the construction industry: Percentage of completion basis

Projects in the construction industry require a long time frame; as such, evaluating profit and cost with the accrual basis is not accurate. The percentage of completion basis is the most reliable accounting method for long-term construction contracts. The percentage of completion basis accounts for the income and expenses associated with the percentage of job completion (e.g., 70%). Under the percentage of completion basis, billing is submitted to the customer for payment of services and materials completed to date. Upon completion of the entire job, a composite of revenue and costs reported to date will indicate the final fixed profit status of the job (Cohan, 2010).

To explain the percentage of completion basis, let's assume the specific project as stated below:

- Contract price: ₩400 million
- Construction period: 4 years
- Budgeted Cost in Construction
- Scheduled Input cost: ₩60, 40, 60, 40 million (each year)

If we follow the cash basis accounting principles it is possible to see that the company will continue to have a deficit for three straight years, then suddenly bring out an earning surprise in the fourth year. Likewise, under the accrual basis accounting principle it will also report the fourth year's earning surprise because the previous years' costs are recognized as inventory instead of revenue. Because of these reasons, production-to-order industries are regulated to use a percentage of completion basis. This method estimates the percentage of project completion periodically and then reports that percentage of the total contract revenue in the income statement (Robinson, 2015; Clough, 2015).

Table 2.2 Comparing Cash Basis Accounting, Accrual Basis Accounting and Percentage of Completion Basis

Cash Basis			
Year	**Revenue**	**Expense**	**Profit (in cash)**
01	-	60	(60)
01	-	40	(40)
03	-	60	(60)
04	400	40	360

Accrual Basis				
Year	**Revenue**	**Expense**	**Inventory**	**Profit (in cash)**
01	-	60	60	-
01	-	40	100	-
03	-	60	160	-
04	400	40	-	200

Percentage of Completion Basis				
Year	**Expense**	**Degree of Completion**	**Revenue**	**Profit (in cash)**
01	60	30%	120	60
01	40	20%	80	40
03	60	30%	120	60
04	40	20%	80	40

** Inventory: Uncompleted constructed works*
** Million, Won*

The major weakness is that there isn't a standardized technique for assessing the percentage of completion of a project. There will be a gap between the real percentage of completion and that of accounting and, as the company calculates revenue for proportions of the contract price, it recognizes

equal proportions of the total estimated contract cost as an expense (Clough, 2015; Cohen, 2015; Stickney, 2009).

2.1.3 Occurrence Process of Unclaimed Invoices in the Construction Industry

The causes of unclaimed invoices in production-to-order industries are as follows. In general cases, payment will be collected by determining a completed amount ratio of customers. In the case of Table 2.2, under the percentage of completion basis, when a customer confirms the completed amount as 20% in the first year of construction, the customer will pay ₩80 million (20% of the total contract cost) in the first year. In this instance ₩40 million would be an unclaimed invoice out of ₩120 million of the company's calculated revenue. In this process, the ₩80 million of the completed amount will be also paid gradually, year by year, so that this part is essentially uncollected money from the construction company's perspective. However, the ₩40 million and the ₩80 million out of the ₩120 million of the uncollected amount are still different in terms of recoverability. Thus, K-IFRS advises that two different amounts should be categorized into separate accounts. In other words, ₩80 million would be counted as a note receivable of construction, while ₩40 million would be counted as an unclaimed invoice.

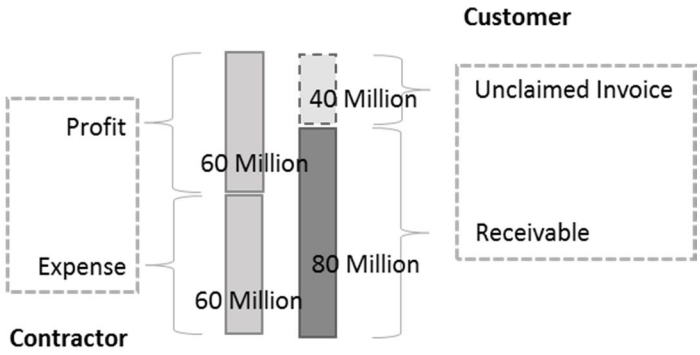

Figure 2.2 Recognizing of an Unclaimed Invoice

2.1.4 Causes of Unclaimed Invoices in the Construction Industry

(1) Causes of unclaimed invoices: Normal situation

First, there can be large amounts of unclaimed invoices in a plant EPC (Engineering, Procurement, and Construction) contract. In EPC the procurement of made-to-order apparatuses, such as turbines and boilers, constitutes about 60% of the whole contract cost. During the production of ordered equipment the percentage of completion increases as input costs already include the purchase of equipment. However, from the customer's point of view, the equipment hasn't been handed over yet, so they won't accept the equipment progress, which results in a difference in how completion progress is recognized. In this case, equipment expenses will be recognized when the equipment installation is completed without delay. Secondly, milestone method contracts lead to an increase in unclaimed invoices. In the milestone method contract, payment is received when the contractor finishes the appointed processes. Lastly, if the customer controls

the timing of the construction claim due to the management of the debt ratio, the lack of budget and so on, there can be a temporary increase in the proportion of unclaimed invoices.

Case 1, when a contractor delays a construction project, and this is not reflected in the estimated cost, the amount of an abnormal unclaimed invoice can increase. In the case of failure in on-time completion due to a delivery delay and inefficient process control, expenses increase as there are various costs, such as additional costs from losses incurred due to delay and rushed work, as well as other indirect costs. In this situation, if the contractor doesn't adjust the cost of sales ratio the unclaimed invoice will increase. As such, additional expenses due to delay mount up in the unclaimed invoice account. Case 2. When the increase in cost is reflected late: If an unexpected factor happens to increase the cost, but this factor is reflected to estimate costs lately by the contractor, then the amount of the abnormal unclaimed invoice can also increase, as in the Case 1 example. Case 3. Underestimation of total cost: When estimated costs are underrated, an excessive unclaimed invoice can occur. The cause can be underestimated construction costs or a low-price booking derived from order competition. Completion progress by input cost is calculated higher than the actual value because the estimated cost is lower than the actual cost in this case, and the numbers of abnormal unclaimed invoices that are not endorsed by customers will gradually increase (Ryu, 2015; Kwon et al., 2015).

The causes of normal unclaimed invoices include plant EPC contracts, milestone contracts, the ordering organization's completion claim controls, and so on. When it comes to the shipbuilding industry, for example, the

portion of heavy tail contract, where more than half of the payment will be given at the time of delivering the ship, is high. So the proportion of unclaimed invoices also increases as input costs increase. However, if the estimated total cost is equivalent to the actual cost and the contractor does not delay the delivery as agreed it is possible to collect the payment at the time of delivery. Instead of the heavy tail method, gradually collecting payments as completion progresses is a more common payment method in the construction industry. Thus, the collection method is not a major factor in the increasing amounts of unclaimed invoices in the construction industry compared to the shipbuilding industry (Kwon et al., 2015).

(2) Causes of excessive unclaimed invoices

The reason for these excessive amounts of unclaimed invoices is as follows. The fluctuations in the construction cost ratio during a project are not directly reflected in the accounting. In the foreign construction market in particular, increasing construction costs frequently occur: in the case of low-price booking, due to a lack of preparation for risk, not being familiar with the foreign market, and so on. If construction costs increase, the construction company (contractor) should reflect the revised construction cost ratio in the accounting. Typically, however, the contractor will postpone the reflection until the project is completed. As such, due to the difference in the cost ratio between the real situation and the accounting situation, a partial amount of the cost of goods sold is added to the unclaimed invoice – causing excessive unclaimed invoices.

The increasing trend in unclaimed invoices may indicate that the contract

condition is degenerating in the construction industry or the contractor is investing more cost in the construction project than originally contracted. If there is a sharp increase in unclaimed invoices, which can be interpreted as a sign of increasing construction costs, careful management is necessary. Such abnormally accumulated unclaimed invoice accounts are very likely to entail a deficit.

2.2 Summary

K-IFRS categorizes construction bonds depending on whether they are claimed or unclaimed, and the claimed amount falls into the 'uncollected amount of construction (공사미수금)' section, whereas the unclaimed amount is recognized in an 'unclaimed invoice'. This is because the contractors calculate the construction progress based on the total estimated costs according to the cost investment method, while the customer pays and recognizes the construction progress based on the completed rate of construction, usually calculated by construction supervision and so on.

But there are some limitations. First of all, under this basis, the major weakness is that there isn't a standardized technique for assessing the percentage of completion of a project. As such, there will be a gap between the real percentage of completion and that reflected in the accounting. This characteristic of an unclaimed invoice can be occurred losses. For example, when a contractor delays construction and this is not reflected in the estimated

cost the amount of abnormal unclaimed invoices can increase and, as the company calculates revenue for proportions of the contract price, it recognizes equal proportions of the total estimated contract cost as expenses. Secondly, there are no systems or standards to assess unclaimed invoice risk. There are many studies to predict bankruptcy and assess business performance, but they don't consider unclaimed invoice accounts; there are few studies that focus on unclaimed invoices.

Because of these reasons, for an exact assessment of performance we need access to internal company information, otherwise stakeholders can't assess how much of the unclaimed invoice will be a loss.

Chapter 3. Methodology Development

3.1 Analysis Flowchart

The flow of overall analysis is described in Figure 3.1. Variables were selected through expert interviews and the literature review. After data relevant to the variables were collected from the financial statements of each company, analyses were conducted as follows. First, the difference in unclaimed invoices between negative profit groups and positive profit groups was analyzed to obtain objective 1 (section 1.3). To achieve objective 2, variables that affect unclaimed invoices were identified from the whole data set. Next, the whole data were divided companies into 2 groups; sound performance group and performance deterioration group. The performance deterioration group was also analyzed to identify the variables that affect unclaimed invoices. The causes of unclaimed invoices that have a high possibility of being a loss were analyzed by comparing these two results from the whole data and the performance deterioration data. Lastly, using these results, objective 3 was achieved. From the results, formulas used to calculate the dangerous of unclaimed invoices were created and classification standards were set. Twenty percent of the whole data were used in the validation process, and verification was conducted using expert interviews.

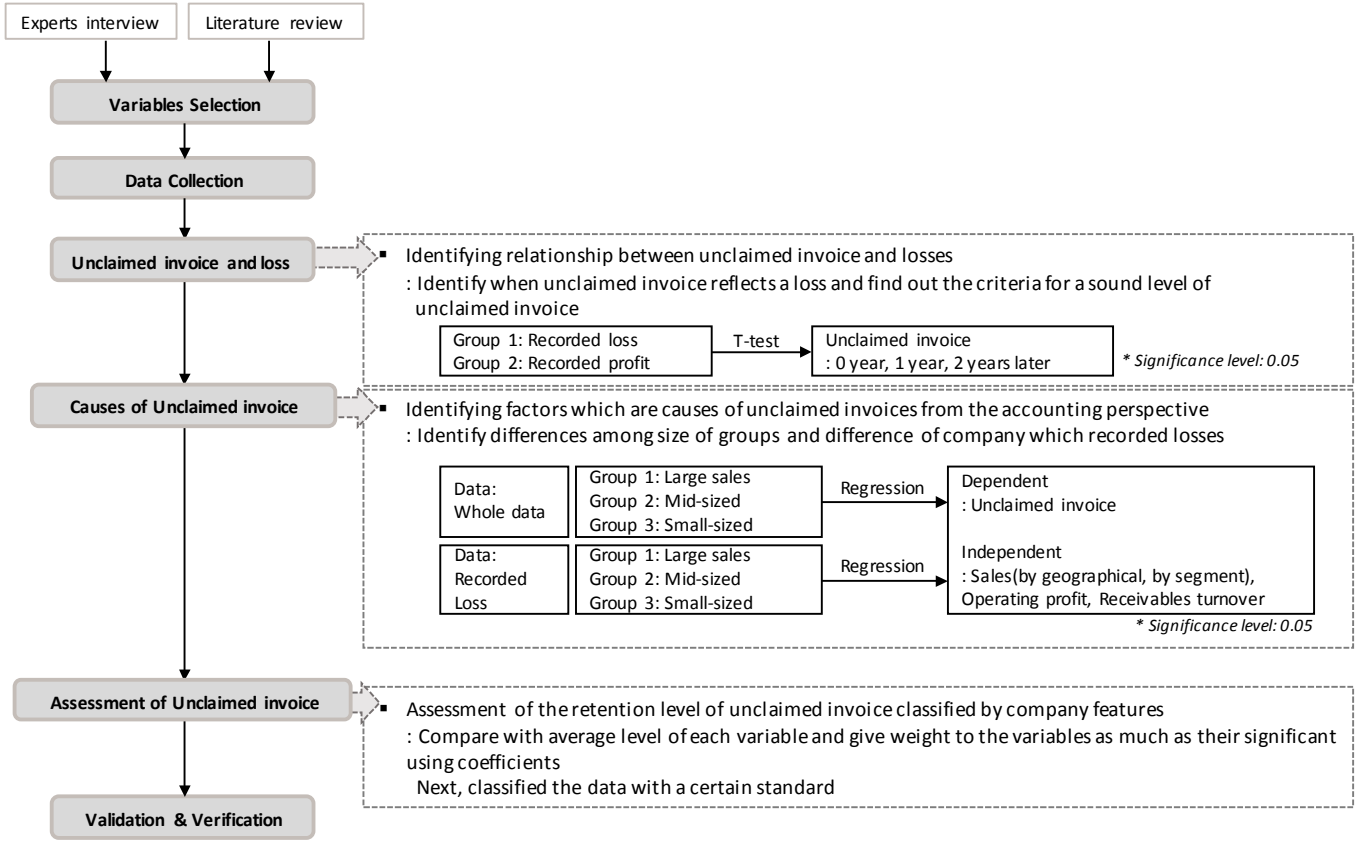

Figure 3.1 Analysis Flowchart

3.2 Variable Selection

First of all, selecting variables must take precedence in order to achieve the objectives of this study. To select variables affecting unclaimed invoices, interviews with experts and the literature review were conducted. Details of the variable selection method are described below.

The interviews were conducted between December 2015 and May 2016. Eight experts were chosen, three were engaged in the management planning department of a construction company, two were engaged in an investment firm and the rest were from a credit rating agency or investment company. The three experts engaged in management planning departments within the construction industry have over 10 years experience in this area. All interviews were face-to-face. Where experts were not available for an interview, reports issued by experts in the credit rating agency and investment company were reviewed as a substitute.

As stated in the literature review, the risk level of certain countries or markets, the contract method with customers, construction cost fluctuations, low-price booking and the level of competition can affect the amounts of unclaimed invoices. The interviews investigated whether companies incurring losses had a tendency to accumulate unclaimed invoices and whether there were some common project features that increased unclaimed invoices. Based on these influence factors that were investigated through the literature review

and interviews, variables in the financial statements were selected for verification using accounting perspectives. Finally, selected variables for identifying unclaimed invoices were: operating profit, sales by geographic region (domestic sales and overseas sales) and sales by segment (construction sales, infrastructure sales and plant sales) in Table 3.1. Detailed explanations of these variables are described below, divided into three sections according to the study objectives.

Table 3.1 Variables

Variables			
	Objective 1	Objective 2	
Dependent Variables	Operating Profit	Unclaimed Invoice	
Independent Variables	Unclaimed Invoice	Sales By geographic region	Domestic
			Overseas
		Sales By segment	Construction
			Infrastructure
			Plant
		Operating Profit	
		Receivables turnover	

3.2.1 Identifying the relationship between unclaimed invoices and losses

(1) Unclaimed invoices

To determine the relationship between unclaimed invoices and losses, *unclaimed invoice* was used as one of the variables. Information on unclaimed invoices is reported in the quarterly financial statements. Unclaimed invoices of 0 year, 1 year and 2 years before the base year were selected to check how long it takes before an unclaimed invoice is reflected as a loss.

(2) Operation profit

There are many kinds of profit in accounting perspectives. In this study, to discover a link between loss and an unclaimed invoice, *operating profit* was selected as representative of the loss caused by an unclaimed invoice. Operating profit indicates how much profit remains after all the operating expenses are subtracted. To yield operation profit, sales and selling, general, and administrative expenses (SG&A) are subtracted from total revenue. This SG&A includes the costs of integrating the various activities of the organization. In addition, bad debt expenses are included in SG&A. It is an expense account that companies may use to record uncollectible customer receivables. Therefore, the amount of operating profit can reflect the loss of uncollected receivables (Gallagher, 2000; Delaney, 2007; Nelson, 2007).

3.2.2 Identifying factors which are causes of unclaimed invoices from the accounting perspective

(1) Unclaimed Invoices

Unclaimed invoice was used as a dependent variable.

(2) Sales

From the interviews and literature review, *total sales*, *sales by geographic region* and *segment revenue* were extracted as independent variables. According to Zhi, H. (1995), project features that impact on the success or failure of a project can be classified into Nation/Region, Construction Industry (construction segment), Company and Project. These features can worsen a company's profitability (An B. H., 2013). Likewise, experts indicated that each construction segment has a different retention level of unclaimed invoices. For instance, overseas projects do not use a unified contract method and vary in demand for product quality. These factors increase the risk of construction delays. In addition, overseas projects have various other factors that can raise construction costs. As a result, sales' features may be a cause of increasing unclaimed invoices.

Under this objective, the study examined which segments of sales affect unclaimed invoice accounts. Sales was divided into construction sales, infrastructure sales and plant sales. Sales by geographic region was divided into domestic and overseas. This classification was the most basic classification standard and had well reflected project characteristics so that it could be applied to all data.

(3) Operating profit

Operating profit was selected as stated in section 3.1.1.

(4) Receivables turnover

Receivables turnover is defined as annual credit sales divided by receivables. Thus, the receivables turnover ratio is expressed as:

$$\text{Receivables turnover} = \frac{Annual\ credit\ sales}{Accounts\ receivale}$$

Receivables turnover is measured by how quickly a company can convert receivables to cash (Mayo, 2011; Weygandt et al., 2002). As unclaimed invoices are also a kind of receivable, receivables turnover can be used to check the amount that couldn't be collected.

3.2.3 Assessment of the retention level of unclaimed invoices classified by company features

All variables stated in section 3.1.2 were used here. Unclaimed invoice was used as a dependent variable. Sales, operating profit and receivables turnover were used as independent variables.

3.3 Data collection and configuration

3.3.1 Data Selection

The scope of this study was limited to the top 50 construction companies identified in the 'Assessing construction capability of construction firms' (conducted annually by Construction Association of Korea; 대한건설협회의 시공능력평가). Data collection for analysis included companies that were listed on the KOSPI/KOSDAQ or subject to external audit. The period

selected for analysis was from 2010 (which was when the amounts of unclaimed invoices began to be published) to 2015. For the acquisition of analytical data the companies which met the following conditions were selected as study samples:

- Companies were listed on the KOSPI/KOSDAQ or were subject to an external audit
- Companies provided financial statements during the analysis period (2010–2015)
- Companies disclosed the amounts of unclaimed invoices
- Companies had a construction section as their core business
- Companies did not record impaired capital during the analysis period

After removing unqualified data, collected data consisted of 45 companies and the total sample size of the data set was 158. Data cleaning and normalization was conducted. For collecting, preprocessing and modeling of the data, Excel and SPSS Statistics were used.

A sample of the collected data is shown in Table 3.2. The following variables investigated by the literature review and expert interview were collected: unclaimed invoices, receivables turnover, operating profit, sales by geographic region (domestic sales and overseas sales) and sales by segment (construction sales, infrastructure sales and plant sales). Total sales and operating cash flow were collected additionally for data grouping purposes.

Table 3.2 Sample of selected Variables

Company	Year	Domestic		Infrastructure		Construction		Plant		Operating profit/sales	Receivables turnover	Unclaimed invoice	
		Sum	Per Sales	Sum	Per Sales	Sum	Per Sales	Sum	Per Sales			Sum	Per Sales
A	2011	59,679	50.06	32,594	27.34	33,102	27.77	55,479	46.54	0.06171	4.38	24,206	20.31
B	2013	58,705	69.74	13,174	15.65	41171.1	48.91	29639.3	35.21	-0.03007	2.54	15,218	18.08
B	2012	55,626	68	13,596	16.62	31,194	38.13	36,595	44.74	0.044644	2.75	13,076	15.98
B	2011	47,817	68	18,121	25.77	26,044	37.04	25,348	36.05	0.044234	2.43	13,587	19.32
B	2010	45,690	68	20,883	31.08	28,613	42.58	16,639	24.76	-0.05275	2.38	12,402	18.46

Company	Year	Sales	Operating cash flow
A	2011	119,202	-155,752,180.
B	2013	84,171	-620,701,049.
B	2012	81,803	-1,210,053,585.
B	2011	70,319	-61,856,669.
B	2010	67,191	-191,545,790.

* For data grouping, sales and operating cash flow were used

3.3.2 Data grouping

(1) By the level of sales revenue

Due to the differences in company features, analyzing all 50 companies in one single action made it difficult to get exact results. A closer look at the data revealed differences between the upper revenue group and lower revenue groups. For example, the plant revenue portion of the top 10 companies were over 40%. On the other hand, companies in lower revenue groups rarely had a plant section. Data was therefore divided into three groups according to the features of the company.

Typically, large industries and SMEs (Small and Medium Enterprise) are classified according to the SME Business Special Laws (중견기업 성장촉진 및 경쟁력 강화에 대한 특별법). This law is set out to classify companies that neither belong to SMEs nor to the 'Mutual investment limited companies' (상호출자제한기업) as medium-sized companies. However, if the companies were split according to this classification criterion (into large companies and SMEs) incorrect analysis could take place due to being weighted only to one group. In this study, therefore, samples were parted into three groups according to the size of sales revenue. This criterion was deemed appropriate to reflect the criterion of 'features of main market, overseas business status, large enterprise status', which tend to appear depending on the size of enterprise. The groups divided by this criterion were as follows: the large group, with a sales revenue with over ₩5000 billion; mid-sized group, with a sales revenue with over ₩1000 billion and below ₩5000 billion; and small-sized group, sales with below ₩1000 million. As the overseas project status

has been identified as the primary growth factor for unclaimed invoices in previous research and expert consultations, it was investigated whether it had a significantly different effect on increasing the amount of an unclaimed invoice by splitting the industries into two groups: one with overseas projects and the other without. As such, there was a small-sized group with overseas projects with over 90% of total revenue and a large group with below 90% of total revenue.

(2) By performance of company

The aim of this classification was to find out the difference in variables of the performance deterioration group. The unclaimed invoices that were likely to result in a loss were identified as having difference causes than that of general unclaimed invoices (i.e. those where the costs would be recovered).The criteria for the performance deterioration group were as follows:

1. Operating profit is negative: A year before recording negative operating profit was included.

2. Operating profit is positive but operating cash flow is negative: Positive operating profit and a negative operating cash flow is an abnormal situation; it means that there is a large amount of money that could not be received.

3. Both operating profit and operating cash flow are negative: A negative operating cash flow indicates a liquidity crisis.

3.4 Selected Method

3.4.1 Regression Analysis

(1) Multiple Linear Regression

Multiple linear regression is a method of identifying the relationship between a dependent variable (Y) and two or more important (X) variables. The purpose of regression analysis is as follows: 1) establish a causal relationship between a dependent variable (Y) and independent variables (X); 2) predict Y based on a set of values of X; and 3) screen variables to identify which variables are more important than others to explain Y, so that the causal relationship can be determined more efficiently and accurately. In this research a major objective of using this analysis is to identify the most important X variables influencing Y and to rank them in order of significance (Yan, X., 2009; Armstrong, R. A. et al., 2010).

The regression model may be written as:

$$Dependent\ variable = A\ function\ of\ independent\ variables + random\ error,$$

$$y = f(x_1, x_2, \cdots, x_p) + \varepsilon$$

However, multiple regression analysis assumes that the X variables are relatively independent of each other. X variables may be affected by correlations between the variables themselves. As such, multicollinearity may have an adverse effect on estimated coefficients in a multiple regression analysis (Mansfield, 1982). It has been suggested that a VIF (Variance

Inflation Factor) larger than 10 probably indicates harmful multicollinearity (Armstrong, R. A. et al., 2010; Hoerl R. et al., 2012; Van, 2002; Roso, 2005). After removing variables over 10 in VIF, analysis was conducted. In regard to significance level, p value at the 0.05 level of significance is sufficiently small to reject the hypothesis (Camm, J. et al., 2014). The adjusted R-squared is a modified R-squared, where the addition of independent variables does not automatically increase R (Woodhouse R., 2003).

(2) Stepwise Regression

When a large number of variables are candidates for model inclusion, a stepwise regression procedure is recommended to select the best set of variables for the model. Also, stepwise regression works well for moderate-sized datasets (Lin, 2011). It is a combination of the best features of two older computational methods: forward selection and backward elimination. The former begins by putting into the model the independent variable having the highest correlation with the dependent variable, and then it adds variables in the order of their ability to explain the remaining variation. The latter begins by including all independent variables in the model and then assesses which variables can be removed with the least loss of explanatory power. First, the computer calculates the regression and residual sums of squares and performs an F-test on the selected variable. If the results are significant the variable enters the model. This stepwise method selects the next independent variable which has a high partial correlation coefficient with the dependent variable. The computer calculates the new regression and residual sums of squares

again. It then computes the increment to R^2 and performs a partial F-test on it; if the results are not significant, the second variable is dropped (Archdeacon, T. J., 1994; Wang, G. G. et al., 2003).

3.5 Analysis Plan

The following three steps were conducted to achieve objective of this research: Step 1, identifying the relationship between unclaimed invoices and losses; Step 2, identifying how much a factor influences an unclaimed invoice and investigating which factors lead to excessive accumulated unclaimed invoices; Step 3, identifying how much a factor influences an excessive unclaimed invoice and classifying the retention level of unclaimed invoices. SPSS 22.0 for Windows was utilized for statistical analysis.

3.5.1 Identifying the relationship between unclaimed invoices and losses

From 2013 to 2014, there were six companies that showed a continuous increase in unclaimed invoices out of seven companies that recorded a deficit. In order to confirm the relationship between unclaimed invoices and losses the statistical significance between the two variables was tested using the t-test. As has been revealed in previous chapters, excessively accumulated unclaimed invoices lead to losses, thus this study identified whether the

unclaimed invoice and the loss variated with some time lag. As such, the time lags of 0, 1, and 2 years were reflected in the unclaimed invoice and sales revenue variable. Considering the case of recording negative sales revenue as a loss, this study proceeded with the analysis by classifying the companies into normal companies and loss companies. Using the t-test, it was revealed whether there was a significant difference in the level of unclaimed invoices or not. Before the t-test, normalization was carried out by dividing the amount of the unclaimed invoice by the sales revenue of the pertinent year.

3.5.2 Identifying factors which are causes of unclaimed invoices from the accounting perspective

Unclaimed invoice was defined by using selected variables. To explain the regression analysis model the formula is described as below:

$$\text{Unclaimed invoice} = Constant_1 + Domestic_i + Infrastructure_i + Construction_i + Plant_i + Operation\ profit_i + Receivable\ turnover_i$$

i=1, 2, …, N

(1) Analysis on causes of unclaimed invoices

Firstly, regression analysis was conducted using the entire normalization data set. Multiple linear regression analysis identified relationships between factors and the accumulated unclaimed invoice, and which variables are important to explain unclaimed invoices so as to predict unclaimed invoices

based on a set of factors.

After that, the data set was divided into three groups according to revenue level (section 3.3.2) and each group had different factors and different significance of factors. It also identified relationships between factors and accumulated unclaimed invoices and distinguished significance variables.

During the whole process, variables with a VIF over 10 were removed to prevent multicollinearity problems and stepwise regression analysis was used to select important variables.

(2) Analysis on the causes of excessive unclaimed invoices in the performance deterioration group

To identify differences in the variables of the performance deterioration group, regression analysis was performed on the performance deterioration group. As stated in section 3.2.2., the performance deterioration group included the following criteria: 1) operating profit is negative, 2) operating profit is positive but operating cash flow is negative, and 3) both operating profit and operating cash flow are negative. After separating the performance deterioration group from the original data set the performance deterioration group was divided into revenue levels as outlined in section 3.3.2. In each revenue group multiple linear regression analysis was used to identify the relationships between factors and excessive accumulated unclaimed invoices, and which variables are important in explaining unclaimed invoices so that we can predict excessive unclaimed invoices based on a set of factors.

3.5.3 Assessment of the retention level of unclaimed invoices classified by company features

After establishing the cause of unclaimed invoices and influence level, an assessment of the retention level of unclaimed invoices was carried out. The regression coefficients were used as weighted value of assessing retention level. The average value of each variable was calculated in advance. The retention level was decided by comparing a company's record with the average level of each variable. For example, let's assume that we try to assess retention levels using a certain company's data. If value of a certain significant variable of company has higher than average value of that variable, multiplied weight and excess amount of the variables. As the data did not have an excess number of significant variables they were ranked as having a 'low retention level'.

$$(V_A - M_A) \times W_A$$

$V_A = value\ of\ variable\ A, M_A = average\ value\ of\ variable\ A,$

$W_A = coefficient\ of\ variable\ A$

Chapter 4. Results of the Empirical Study

4.1 Descriptive Statistics

4.1.1. Total data

The descriptive statistics of construction companies used to build a model for multiple regression analysis are shown in Table 4.1. Average sales were ₩3,937.3 billion, operating profit was ₩118.3 billion, which was 0.02% of total revenue. The average rate of domestic sales was 75.59%, while the remaining sales were overseas sales. The proportion of infrastructure was 20.41%, construction had the highest percentage of sales and plant operations had 21.62%. The receivables turnover norm was 3.47. The average amount of an unclaimed invoice was ₩642.5 billion, comprising around 14.78% of total revenue.

Table 4.1 Descriptive Statistics for Total Data set

Variables		M	SD	MIN	MAX
Operating Profit		1,183.87	2,672.49	-9,354.50	9,865.60
	(%)	0.02	0.07	-0.36	0.23
Total Sales		39,373.42	41,045.07	1,276.00	191,220.50
Domestic Sales		24,248.06	23,760.26	1,276.00	94,587.75
	(%)	75.59	24.89	9.37	100.00
Infrastructure Sales		5,827.02	7,063.99	0.00	35,707.20
	(%)	20.41	14.38	0.00	64.58
Construction Sales		11,426.78	12,606.58	0.00	66,089.30
	(%)	40.67	26.90	0.00	98.39
Plant Sales		13,342.19	20,766.33	0.00	83,208.60
	(%)	21.62	28.15	0.00	93.95
Receivable turnover		3.47	1.77	0.96	11.92
Unclaimed Invoice		6,424.54	8,422.62	10.00	51,011.00
	(%)	14.78	8.42	0.12	35.87

4.1.2. Classified by revenue size and performance of company

(1) Classified by revenue size

The large group had the highest operating profit; it was 19 times greater than the profit of the mid-sized group. The sales revenue of the large group was composed of plant, construction and infrastructure in descending order, while the sales revenue of mid-sized and small-sized groups was composed of construction, infrastructure and plant in descending order. According to the proportion of domestic sales, the large group showed the smallest share, while the small-sized group showed the greatest share. The groups holding less than 90% of the total domestic construction market share (groups with a high proportion of foreign construction) were measured to have amounts of unclaimed invoices that were, on average, about seven times greater than the groups with more than 90% of the domestic construction market share. Total sales revenue and operating profit also appeared to be lower in the groups with a high proportion of domestic construction than groups with a low proportion. In conclusion, the large group had more sales in overseas construction and plant operations than the others.

Table 4.2 Descriptive Statistics for the Large group

Variables		M	SD	MIN	MAX
Operating Profit		3,475.10	3,542.41	-9,354.50	9,865.60
	(%)	0.04	0.04	-0.10	0.08
Total Sales		94,452.55	28,087.32	51,462.90	191,220.50
Domestic Sales		53,170.36	22,172.94	19,451.60	94,587.75
	(%)	56.39	18.91	25.20	90.08
Infrastructure Sales		11,609.88	10,127.67	0.00	35,707.20
	(%)	11.83	8.86	0.00	31.08
Construction Sales		22,598.18	16,333.55	0.00	66,089.30
	(%)	23.40	15.07	0.00	56.52
Plant Sales		38,291.57	21,108.57	0.00	83,208.60
	(%)	43.24	23.40	0.00	89.29
Receivable turnover		3.44	1.24	2.19	6.51
Unclaimed Invoice		15,405.08	9,783.55	516.00	51,011.00
	(%)	16.63	6.91	0.41	29.48

Table 4.3 Descriptive Statistics for the Mid-sized group

Variables		M	SD	MIN	MAX
Operating Profit		180.53	1,567.30	-4,393.80	4,429.80
	(%)	0.01	0.07	-0.24	0.15
Total Sales		22,088.77	11,967.83	8,472.00	73,485.10
Domestic Sales		15,963.49	8,073.01	2,459.00	41,455.00
	(%)	76.21	23.67	9.37	100.00
Infrastructure Sales		4,781.50	2,100.67	1,034.00	11,559.40
	(%)	24.79	10.84	6.04	55.46
Construction Sales		8,803.90	6,477.21	0.00	30,431.00
	(%)	40.48	21.65	0.00	78.06
Plant Sales		3,726.56	6,876.00	0.00	32,931.00
	(%)	15.82	25.54	0.00	93.95
Receivable turnover		2.67	0.91	0.96	5.38
Unclaimed Invoice		3,882.83	3,366.63	470.20	15,922.00
	(%)	17.28	9.04	6.07	35.87

Table 4.4 Descriptive Statistics for the Small-sized group

Variables		M	SD	MIN	MAX
Operating Profit		167.43	501.96	-2,214.00	1,171.20
	(%)	0.02	0.09	-0.36	0.23
Total Sales		5,923.43	2,414.47	1,276.00	10,855.90
Domestic Sales		5,638.97	2,570.25	1,276.00	10,855.90
	(%)	94.38	15.72	30.27	100.00
Infrastructure Sales		1,300.33	1,126.77	0.00	3,949.00
	(%)	23.41	18.79	0.00	64.58
Construction Sales		3,477.66	2,585.65	0.00	10,124.90
	(%)	58.55	31.01	0.00	98.39
Plant Sales		546.42	1,751.07	0.00	8,132.90
	(%)	7.18	22.76	0.00	92.71
Receivable turnover		4.43	2.42	1.55	11.92
Unclaimed Invoice		605.83	542.55	10.00	2,221.00
	(%)	10.07	7.04	0.12	29.84

(2) Classified by performance of company: performance deterioration group

To find significant differences between the unclaimed invoices of positive profit and negative profit companies, data were filtered out poor performance records.

Table 4.5 Descriptive Statistics for the Performance deterioration group

Variables		M	SD	MIN	MAX
Operating Profit		162.51	2490.88	-9354.50	7604.00
	(%)	0.00	0.08	-0.19	0.24
Total Sales		32,359.22	33,527.65	1,276.00	119,202.00
Domestic Sales		19,980.50	17,638.63	1,276.00	85,065.75
	(%)	79.52	22.66	25.20	100.00
Infrastructure Sales		5,226.47	5,601.93	0.00	32,594.00
	(%)	23.80	16.69	0.00	64.58
Construction Sales		9,388.85	9,747.44	0.00	41,171.10
	(%)	41.36	26.29	0.00	98.26
Plant Sales		10,555.54	17,925.43	0.00	62,252.00
	(%)	18.61	25.36	0.00	81.67
Receivable turnover		2.93	1.17	0.96	7.20
Unclaimed Invoice		5,590.51	6,247.29	11.00	24,206.00
	(%)	16.28	8.78	0.23	42.90

Table 4.6 Descriptive Statistics for the Sound financial performance group

Variables		M	SD	MIN	MAX
Operating Profit		2437.63	2676.68	40.00	9866.00
	(%)	0.06	0.05	0.00	0.00
Total Sales		45,621.03	44,954.21	2,164.00	173,870.00
Domestic Sales		27,426.99	27,428.04	1,540.00	94,588.00
	(%)	69.47	27.11	9.00	100.00
Infrastructure Sales		6,210.67	8,139.36	0.00	34,790.00
	(%)	17.18	11.96	0.00	53.00
Construction Sales		11,856.13	13,367.74	0.00	56,653.00
	(%)	35.67	27.81	0.00	98.00
Plant Sales		16,921.62	23,103.63	0.00	78,468.00
	(%)	28.20	32.16	0.00	94.00
Receivable turnover		3.99	2.10	2.00	12.00
Unclaimed Invoice		7,377.03	9,660.86	28.00	51,011.00
	(%)	14.16	8.54	0.00	33.00

4.2 Results

4.2.1 Discovering a link between losses and unclaimed invoices

(1) Whole data set

The result of the relationship between losses and unclaimed invoices is shown in Table 4.7. Unclaimed invoice that two years before occurring losses has significant value. Whether there was a loss in the amount of unclaimed invoices two years ago or not showed a significant value within a 5% significance level. Conducting the same analysis with the amounts of unclaimed invoices in contrast to the revenue also showed that there was a significant difference between the two groups such as negative profit group and positive profit group. When the cases before and after the loss were compared, significant values within the p-value less than 5% were observed in sales, infrastructure sales, plant sales, operating profit, operating cash flow, unclaimed invoices, retained earnings and total equity. This means that there are significant differences between the loss group and normal group in sales, infrastructure sales, plant sales, operating profit, operating cash flow, unclaimed invoices, retained earnings and total equity. Using regression analysis, the relationship between the financial data and the loss was investigated for the year prior to the loss. Regression analysis was performed by entering the operating profit as a dependent variable and unclaimed invoices as an independent variable. It was found that the value of the coefficient regression was 0.478 and had a significant probability of 0.000. As a result, it is possible that there was a causal relationship between the

unclaimed invoice and the loss, and thus it means that there is a need to watch out for losses if there is a change in the amount of unclaimed invoice.

Table 4.7 Comparisons of time lag between profit statuses

Variables		Negative profit			Positive profit			p
		N	M	SD	N	M	SD	
Rate of change o	0yr before	70	0.836	0.439	72	0.676	0.435	0.763
Unclaimed	1yr before	46	0.439	0.333	52	0.083	0.470	0.222
Invoice/Revenue	2yrs before	39	0.045	0.316	31	0.176	0.600	**0.029 ***

* p<0.5

In addition, 17 out of 23 enterprises where the losses occurred tended to show decreases in unclaimed invoices. Table 4.7 shows via the t-tests that a significant difference exists between the negative profit group and positive profit groups in the amount of growth of unclaimed invoices in contrast to the previous year. This is deemed to be due to the fact that a decrease in the amount of an unclaimed invoice led to a loss.

4.2.2 Identifying factors which are causes of unclaimed invoices from the accounting perspective

The causes of unclaimed invoices revealed in the literature review and interviews as stated in Chapter 3, were verified in this chapter. Data were grouped by revenue levels. Normalization was conducted for preprocessing. To avoid multicollinearity, factors that had a VIF over than 10 were excluded from the model. Through stepwise regression, variables that didn't significantly affect the dependent variables were also removed. And there was

no significant differences between regression model and mixed effect model. So mixed effect was not adopted.

(1) Classified by level of revenue

The results of estimating the impact factors of unclaimed invoices by sample group of sales level using Stepwise regression are shown in Table 4.10. The selected study samples were divided into the sample groups according to the different sales levels and each group was used for each empirical model. There was not a large difference between the R values and the Adjusted R square values and this has sufficient explanatory power. VIF values were checked for a multicollinearity problem. The maximum figure was 2.059.

First, it was confirmed that there can be a large amount of unclaimed invoices in plant EPC contracts. Plant revenue significantly influenced unclaimed invoices in the large revenue group. It was possible to confirm that the groups with large revenue has large proportion in plant market, and generated a lot of unclaimed invoices in this market. While the input cost of ordered equipment increased the percentage of completion, customer didn't recognize equipment that hadn't yet been handed over. This difference in perception led to unclaimed invoices.

As overseas sales increased, unclaimed invoices also increased. Overseas sales had an influence on the increase in unclaimed invoices in the case of medium-sized and high-sized groups in sales, while this factor was not selected as a significant variable in the small-sized group in sales. A close look at companies' financial reports revealed that plant contracts were almost always linked to overseas construction contracts. Large amounts of overseas

contracts in plant operations could contributed to the increase in unclaimed invoices. On the contrary, the small-sized group usually had very few overseas contracts. The average proportion of domestic sales in the small-sized group was 94.38. This is because the small-sized group in sales has a small probability of overseas advancement. In this case, therefore, overseas sales are not a significant variable that affects unclaimed invoices.

Table 4.8 Regression analysis of each group divided into revenue

No.	Dependent variables	Indepentent variables	B	β	t	R	R^2	Adjusted R^2	VIF	F
Large-sized	Unclaimed invoice	Domestic	.386	.386	4.424**	0.914	.834	.823	2.019	73.947**
		Infrastructure	.387	.387	5.502**				1.314	
		Plant	.331	.331	3.760**				2.059	
Mid-sized	Unclaimed invoice	Domestic	.708	.708	8.747**	0.796	.634	.621	1.054	51.055**
		Construction	.238	.238	2.939**				1.054	
Small-sized	Unclaimed invoice	Infrastructure	.838	.838	11.793**	.888[b]	.788	.778	1.048	81.754**
		Construction	.522	.522	7.351**				1.048	

(2) Performance deterioration group: Classified by level of revenue

In this section, performance deterioration group was selected. As per other analyses, normalization was conducted for preprocessing. To avoid problems of multicollinearity, factors that have a VIF over 10 were excluded from the model. Through stepwise regression, variables that didn't significantly affect the dependent variables were removed.

Analysis of the relationship between variables and unclaimed invoices per total revenue for the large sales group uncovered three significant variables: domestic sales, infrastructure sales and receivables turnover. Domestic sales and receivables turnover had a negative association with unclaimed invoices, which indicated that there is a low risk of unclaimed invoices under retention of high domestic sales or high receivables turnover. Infrastructure sales was identified as a significance variable, meaning that a high proportion of infrastructure sales is a vulnerable feature. However, analysis by sum (not proportion) of plant sales was selected as the significant variable. Its b value was found to be 0.555.

In the mid-sized group there is no significant variable when using variables that were divided by revenue to get the proportion. However, there was a significance difference in the total sum of plant sales and construction sales. Each regression coefficient was 0.536 and 0.404 respectively.

In the small-sized group both the proportion of infrastructure sales and receivables turnover were selected as significant variables. In the groups with low revenue, the coefficient of receivables turnover was found to be -.379 and that of infrastructure was found to be 0.605. Receivables turnover was in inverse ratio to the unclaimed invoices.

Table 4.9 Regression analysis of performance deterioration companies

	No.	Dependent variables	Indepentent variables	B	β	t	R	R^2	Adjusted R^2	VIF	F
Per sales	Large-sized	Unclaimed invoice	Domestic	-.874	-.874	-5.551**	0.895	.802	.756	1.625	17.511**
			Infrastructure	.485	.485	2.798*				1.969	
			Receivables turnover	-.336	-.336	-2.321*				1.376	
	No.	**Dependent variables**	**Indepentent variables**	**B**	**β**	**t**	**R**	**R^2**	**Adjusted R^2**	**VIF**	**F**
Sum	Mid-sized	Unclaimed invoice	Plant	.536	.536	2.964**	0.54	.292	.235	1.155	5.149*
			Construction	.404	.404	2.231*				1.155	
	No.	**Dependent variables**	**Indepentent variables**	**B**	**β**	**t**	**R**	**R^2**	**Adjusted R^2**	**VIF**	**F**
Per sales	Small-sized	Unclaimed invoice	Infrastructure	.605	.605	4.452**	0.856	.733	.704	1.311	26.029**
			Receivables turnover	-.379	-.379	-2.792*				1.311	

4.2.3 Assessment of the retention level of unclaimed invoices classified by company features

Firstly, set the level including 90% of total data among the performance deterioration group. And it was 8%. As such, when an unclaimed invoice per sales is under 8%, it can be interpreted that it has little risk. If the unclaimed invoice is over 8%, it has to compare with significance variables in performance deterioration group. Finally, the weight and the excessive amount of variables were calculated.

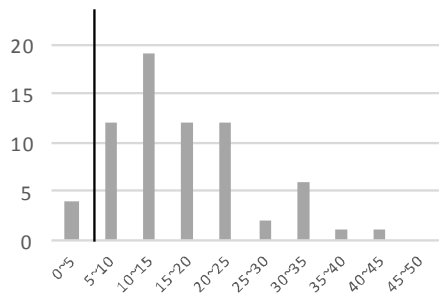

Figure 4.1 Distribution of unclaimed invoice in performance deterioration group

Let's assume a situation that assesses the retention level of a certain company, and the company's unclaimed invoice per sales is greater than 8%. In this case it should be compared with a set of significant variables like Figure 4.2.

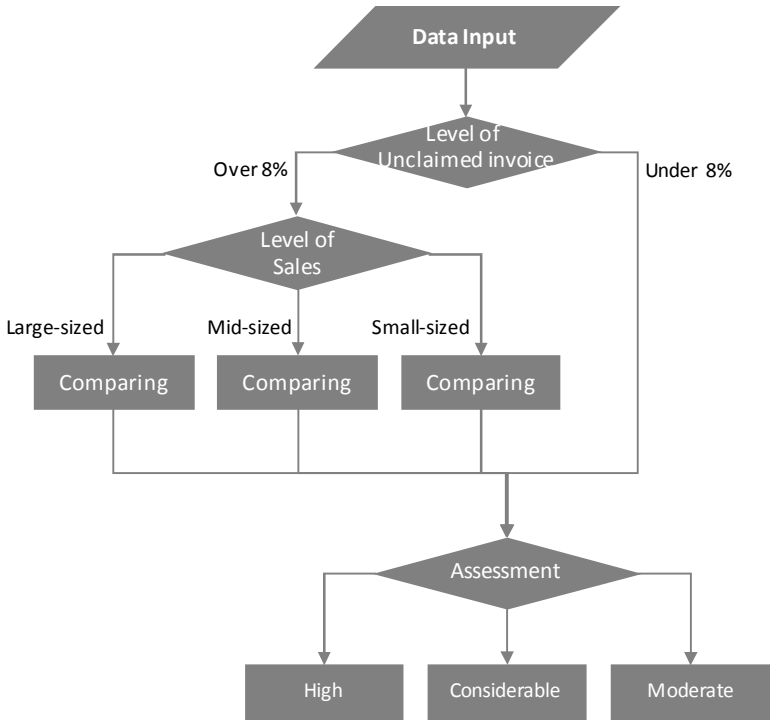

Figure 4.2 Assessment Unclaimed Invoice

In comparing part of Figure 4.2, formulas were used to calculate risk point. Weight was from coefficient in Table 4.13.

Large-sized:

$$(V_1 - V_{1m}) \times -0.874 + (V_2 - V_{2m}) \times 0.485 + (V_5 - V_{5m}) \times -0.336$$

Mid-sized:

$$(V_4 - V_{4m}) \times 0.536 + (V_3 - V_{3m}) \times 0.404$$

Small-sized:

$$(V_2 - V_{2m}) \times 0.605 + (V_5 - V_{5m}) \times -0.379$$

V_1 : Domestic sales, V_{1m} : Mean of domestic sales(69.47), V_2 :

Infrastructure sales, V_{2m} : Mean of infrastructure sales(17.18), V_3 : Construction sales, V_{3m}: Mean of construction sales(35.67), V_4: Plant sales, V_{4m}: Mean of plant sales(28.20), V_5: Receivables turnover, V_{5m}: Mean of receivables turnover(3.99)

After calculated risk point, whole data were classified into 3 parts such as high level, considerable level and moderate level depending on the risk level of unclaimed invoice. In case of large-sized group, mid-sized group and small-sized group, classification standard is stated as below.

Large-sized group:

High: Over 9.03 point

Considerable: Between 1.97 point and 9.03 point

Moderate: Less than 1.97 point or less than 8% of unclaimed invoice per sales

Mid-sized group:

High: Over -2.41 point

Considerable: Between -2.41point and -7.10 point

Moderate: Less than -7.10 point or less than 8% of unclaimed invoice per sales

Small-sized group:

High: Over 16.98 point

Considerable: Between 8.44 point and 16.98 point

Moderate: Less than 8.44 point or less than 8% of unclaimed invoice per sales

As the result, validation was conducted by using 20% of whole data and verification was conducted by expert's interview. Expert's verification was 'positive enough to use this model for assessing unclaimed invoices'. This model had 83.3% of accuracy. In case of large-sized revenue group, there was no error. In mid-sized group and small-sized group, accuracy rates were 75%.

Chapter 5. Conclusions

5.1 Summary

This research has identified the causes of unclaimed invoices and provided a standard for assessing excessive unclaimed invoices. A literature review, along with expert interviews, were conducted to define the issue of the 'unclaimed invoice'. This research first discovered a relationship between losses and unclaimed invoices. Unclaimed invoice that two years before occurring losses has significant value by conducting t-test. Secondly, it investigated the causes of unclaimed invoices through an empirical study and investigated what makes the amounts of unclaimed invoices excessively increase in financial statements. Next performance deterioration group was divided into 3 groups; large sales group, mid-sized sales group and small-sized sales group. By conducting regression analysis, significant variables that affect unclaimed invoice were identified. For the large sales group uncovered three significant variables: domestic sales, infrastructure sales and receivables turnover. In mid-sized group, there was a significance difference in the total sum of plant sales and construction sales. Lastly, in the small-sized group both the proportion of infrastructure sales and receivables turnover were selected as significant variables. Finally, using these factors and coefficient values, formulas that assess risk level of unclaimed invoice were defined. All the

result was classified into high level of dangerous, considerable level and moderate level. This research identified the risk associated with unclaimed invoices in Table 5.1.

Table 5.1 Classification standards of riskiness of unclaimed invoice

	Large-sized	Mid-sized	Small-sized
High	$x \leq 9.03$	$1.97 \leq x < 9.03$	x <1.97
Considerable	$x \leq -2.41$	-7.10 $\leq x < -2.41$	x <-7.10
Moderate	$x \leq 16.98$	$8.44 \leq x < 16.98$	x <8.44

5.2 Contributions

Since information surrounding unclaimed invoices are available to the public, this study reveals the risk associated with excessive amounts of unclaimed invoices and aids transparency in company accounts. It will contribute to reducing the adverse selection of stakeholders as a result of information asymmetry and help them to accurately assess a company's performance. Ultimately, it will help increase the financial health of Korea's construction industry, as well as the efficiency of the market.

5.3 Future Study and Limitations

Although this study has contributed to this field of research by conducting an empirical study of unclaimed invoices using real data, it didn't consider comprehensive situations of certain company's situations such as experts' insight.

This research conducted an investigation into the unclaimed invoices of enterprise units. There was a limitation in the detailed analysis because the total amount of unclaimed invoices was used as the dependent variable. However, an in-depth analysis of the markets and the projects which cause unclaimed invoices could be undertaken if research can be conducted based on information related to specific markets and newly disclosed projects.

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초 록

최근 건설사의 잇따른 영업이익 하락과 미청구공사 금액의 증가가 한국 건설산업의 재무적 이슈로 지적되고 있다. 건설업과 같은 수주산업의 회계처리에서는 투입된 비용을 바탕으로 진행률을 산정하게 된다. 이 때, 건설사의 진행률과 발주처가 인정한 진행률 간의 차이로 인해 아직 발주처로부터 승인 받지 못한 금액을 미청구공사라고 한다. 과도하게 쌓인 이러한 미청구공사는 손실로 전이될 가능성이 높다고 지적되고 있으며, 미청구공사가 증가할 수 있는 다양한 상황이 존재하기 때문에 기업 외부 관계자가 위험성을 사전에 판단하기란 쉽지 않은 실정이다. 게다가 미청구공사의 위험도를 판단하는 선행연구 및 판단기준의 부재와 제한적인 공시정보는 미청구공사의 정확한 파악에 대한 어려움을 가중시켰고, 이는 시장혼란 및 효율성 저하와 연결된다. 따라서 본 연구의 목표는 기업 미청구공사의 보유수준이 건전한지 혹은 위험한지 파악하는데 활용할 수 있도록 재무제표 상의 계정들 중 미청구공사와 관련이 있는 핵심인자를 추출하고 이를 통해 위험성을 판단하는 식을 제시하고자 한다.

첫째로 문헌고찰과 전문가 인터뷰를 통해 변수를 선정했고, 선정된 변수에 대한 데이터를 수집하였다. 둘째로, 미청구공와 손실사이에 어떠한 상관관계가 있다는 것을 확인하였다. 이 후, 수집된 데이터를 매출액 분위별로 나눠서, 어떤 변수가 미청구공사에 영향을 미치는지 회귀분석을 통해 분석하였다. 또한 경영악화를 기록한 데이터에 대해서도 매출액 분위별 분석을

실시하여, 손실로 전이될 가능성이 높은 미청구공사에 영향을 미치는 변수를 확인하였다. 영향을 미치는 변수와 그 회귀계수를 활용하여 미청구공사의 위험도를 도출하는 식을 제시하였으며, 각 데이터에 대한 계산값들은 손실여부를 기준으로 세가지 그룹(위험도 상, 중, 하)으로 나누고 그 기준값을 제시하였다.

본 연구를 통해, 기업 외부관계자들이 미청구공사의 위험성을 판별할 수 있는 기준을 제시하였으며, 본 연구의 기여는 정확한 미청구공사의 위험성 판단을 기반으로 한 건전한 시장 형성에 있다. 건설기업 공시 기준의 변경으로 인해 향후 세분화된 기업 미청구공사 금액 데이터가 쌓인다면, 좀 더 정확도가 높은 모델을 제시할 수 있을것이라 생각한다.

주요어: 미청구공사, 건설기업 회계, 진행주의 회계, 수주산업 회계, 건설기업 어닝쇼크

학 번: 2014-22710