Factoring Account Receivables towards Mitigating Cash Flow Fluctuation for
Construction Projects

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Abstract — The objective of this study is to mitigate cash flow fluctuation for construction projects with the use of factoring account receivables, which is a generally accepted financial tool that has thus far not often been used for construction project financing. The relevant literature, empirical practices, and factoring theories from outside the construction industry are all evaluated and the features of needed to derive the cost function are explored and integrated. A case study is utilized and discussed to illustrate the use of factoring for a construction project and its related costs. The results show that using factoring account receivables mitigates cash flow fluctuation around 50% for a $183 million New Taiwan Dollar project. In addition, the application of factoring has the advantage of facilitating financial management, instantly improving cash flow, enhancement of investment efficiency, avoiding extra loan procedures, improving credit rating, and transfer of financial risk. Factoring is indeed a feasible financial tool for construction projects.

Index Terms — factoring, accounts receivable, cost, financing, construction project.

I. INTRODUCTION

In the construction business the contractor needs to maintain a high volume of working capital. It is necessary to preserve a certain volume of working capital to deal with inevitable fleeting huge cash outflows. This can lead to financial burdens if payments from the owners are delayed or the set payment period is too long. The most commonly used way to resolve this type of problem is financing from banks. However this may be costly. Other financing alternatives are used to reduce cash flow fluctuation brought about discussions in the construction industry \([1]\).

Factoring account receivables has successfully been implemented in many other industries but not for the construction industry. Factoring is globally accepted as a means of raising short-term capital for financial needs. It was derived from the US textile industry \([2]\) and has spread out to over the last century to about 50 countries.

Factoring services provide multiple benefits to including the reducing and transferring of credit risks, improving cash flows, lowering financial administration costs, and increasing efficiency and productivity \([3]\). The feasibility of implementing factoring for construction projects has not yet been discussed. To do this cost considerations from the contractor’s viewpoint need to be explored first.

Mitigating cash flow fluctuation using factoring account receivables in the viewpoint of a contractor is the objective in this study. The focus is on the lump-sum type of construction projects with fixed payment terms and periods. Account receivables for construction projects are defined as the payment that the contractor will collect from the owner when the corresponding work activities and items are completed by the contractor, who has received receipt(s) or invoice(s) from the owner. The contractor’s viewpoint only considers the general contractor’s standpoint, not that of subcontractors, suppliers, or vendors. Contract disputes subject to any penalty claim are also not included. The application and integration of the features of construction projects, the factoring concept, and the contractor’s costs for factoring, can are explained using mathematics and a case study.

II. DISBURSEMENT AND FINANCING OF CONSTRUCTION PROJECTS

Most medium- to large-sized construction projects require outside funding. A study shows that 66.28% of these funds are provided by financial institutions \([4]\). Financing can be divided into two types based on the time scale: short term, which is less than one year, or long term, which represents over one year. Users need to consider the character and advantages of each type before deciding which to apply to their projects. For example, short-term financing can be obtained more quickly and more flexibly but may more easily cause bankruptcy if the payback period becomes due without sufficient returned payments. Long-term financing usually means higher interest rates, more constraints, and a more complicated application progress, which makes it harder for small or medium companies to raise funds. Nevertheless, the impact to the user and risk of bankruptcy is lower.

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III. FACTORING MARKET AND FEATURES

According to the Factors Chain International (FCI), in 2006 the total factoring volume reached $11.342 trillion USD worldwide. The growth rate compared to the volume in 2005 is around 12% [5]. Factoring has advantages over other type of lending for firms in developing economies [6]. The number of small to medium business, especially medical, construction material, and construction venders, has increased recently because of the use of factoring [7]. In Taiwan, studies on factoring have been done in many industries other than the construction industry. The features of the construction industry are different, and the use of factoring in the industry is in its beginning stages [1], [8]. However the use of factoring so far still highly concentrated in a few countries and industries [3] is expanding in many parts of the world including the Asian region.

There are two types of factoring in common use: recourse and non-recourse. Factoring with recourse entitles the factoring institution to make payment claims to the supplier if the account payment defaults. In non-recourse factoring, the factoring institution has no claim which reduces and transfers the supplier’s credit risk [9]. Determinants for choosing factoring as a source of finance for working capital and a tool for cash flow improvement have been discussed by other researchers [10]. Merx pointed out that one reason that factoring is popular is because cash can be collected in a day or two through selling receivables much faster than the general 30 to 60 day collection period. It is also more flexible in terms of cash conversion cycle [11]. When profit margins, interest rates, credit protection, and timeliness need to be considered, factoring helps to reduce international trade risk [12].

IV. FACTORING COSTS AND EMPIRICAL CASE STUDY

A. Contractor Costs Using Factoring

Basically factoring is a package of services involving three parties - supplier, buyer, and factor (Figure 1). For construction projects, the supplier means the contractor, who uses factoring to improve his/her cash-flow, while the buyer indicates the owner. During the factoring process, credit approval is first issued and, under a factoring relationship, a discounted advance payment of the invoice amount is granted to the contractor. A typical advance rate may vary from 70% to 90%, with a reserve in a range of 30% to 10%. When the invoice from the owner is paid in full, the contractor can receive the reverse amount less a commission fee which usually varies from 1% to 5% [8]. Based on the mechanic (Figure 1) and disbursement concepts described in the previous section, the contractor’s costs for using factoring can be derived, beginning with the factor’s commission fee. The range of the commission fee varies and how it is determined is usually confidential.

\[
f(x_i) = x_i \left[p_i \left(1 - r \right), D_i, \alpha_i, \beta_i\right], \tag{1}
\]

where \( f(x_i) \in [0,1] \); \( i \) is the \( i^{th} \) period and \( i \in [0,N] \); \( N \) is the total number of progress payments; \( p_i \) is the progress payment amount for the \( i^{th} \) period; \( r \) is the percentage of money reserved for work completed in the \( i^{th} \) period; \( D_i \) indicates the length of the \( i^{th} \) period in days; \( \alpha_i \) is the contractor’s credit quota; and \( \beta_i \) is the owner’s credit quota in the \( i^{th} \) period.

For a construction project, reducing \( f(x_i) \) stands if \( D_i \) is shortened and \( p_i \) is smaller, where \( \alpha_i \) and \( \beta_i \) are normally constant during a short period of time. We find that the total commission fee by summing up all \( i \)

\[
\sum_{i=0}^{N} \left[f(x_i) \times A_r \times p_i \left(1 - r \right)\right] \tag{2}
\]

Fig. 1. Factoring mechanics for a construction project

The variables affecting commission fees include the total amount, length of contract period, contractor’s credit, and owner’s credit [13]. The contractor may need to pay an additional credit monitoring fee to the factor. This fee depends on the credit risks of those who are monitored, that is, the contractor and the owner. Generally the commission fee function \( f(x_i) \) for the \( i^{th} \) period of time is expressed as
where $Ar$ is the advance rate in the $i^{th}$ period of time. Supposed that $Ar$ is usually set to a constant throughout the construction project, Equation (2) can be rewritten as

$$Ar \sum_{i=0}^{N} [f(x_i) \times p_i (1 - r)]$$

(3)

Factoring with recourse occurs when the factor faces higher credit risks. To identify recourse causing debt to the contractor, we set

$$R = \begin{cases} 1, & \text{if recourse occurs} \\ 0, & \text{if recourse does not occur} \end{cases}$$

(4)

We introduce a probability $P$ to explain the probability of not paying back by the contractor if recourse occurs. $P \in [0,1]$, $P = 1$ if the contractor absolutely fails to pay anything back, and vice versa. The costs caused by recourse to the contractor can be defined by

$$R \times P \times \left( \sum_{i=0}^{N} p_i (1 - r) + Ar \sum_{k=0}^{N} p_k \right)$$

(5)

where $j$ is the $j^{th}$ time period when recourse occurs to payment $p_j$, and can be independent of $i$; $k$ is the $k^{th}$ time period when recourse occurs to the reserve of payment $p_k$; $i$, $j$, and $k$ are independent.

The contractor may need to pay an additional credit monitoring fee to the factor. This fee depends on the level of credit risks of those who are monitored, that is, the contractor and owner. Assuming that $\phi \in [0,1]$ is the percentage which the factor charges the contractor, usually a constant, we obtain

$$\phi \sum_{m=0}^{N} [\delta(y_m) + \varepsilon(y_m)]$$

(6)

where $m$ is in the $m^{th}$ time period and is independent of $i$, $j$, and $k$ ; $\delta(y_m)$ and $\varepsilon(y_m)$ are the volatile monitoring fee for the contractor’s and owner’s financial statuses, respectively, in the $m^{th}$ period. Both are a function dependent on the credit conditions for those being monitored.

Adding up all costs from Equations (3), (5), and (6) we obtain the total cost of using factoring

$$Ar \sum_{i=0}^{N} [f(x_i) \times p_i (1 - r)] + R\left( \sum_{i=0}^{N} p_i (1 - r) + Ar \sum_{k=0}^{N} p_k \right) + \phi \sum_{m=0}^{N} [\delta(y_m) + \varepsilon(y_m)]$$

(7)

Equation (7) is the contractor cost function for factoring account receivables for conducting a construction project, considering commission fee, recourse costs, and monitoring fee charged by the factor.

B. Empirical Case Study

There are no construction contractors in Taiwan who apply factoring to their projects. To simulate the costs of the use of factoring on a construction project we randomly collected detailed information about a medium sized construction project. This is a typical building project size, making up the largest proportion of the construction types in Taiwan. We also interviewed 7 factoring experts before deriving numerous assumptions used for factoring practices in most industries. The examined project has the following characteristics: project size of $183,066,910$ New Taiwan Dollars (NTD), project duration of 52 months, 49 progress payments, and 10% reserve. Based on the check clearing mechanics in Taiwan, the cash conversion cycle for each check is set to 75 days. During the construction period, there is no project financing; therefore, the total costs come to $173,913,564$ NTD, resulting in a profit margin of approximately 5%. The actual cash flows are shown in Figure 2.

The project cash outflows reach the maximum of 13.3% of the project size at the 11th month from construction startup. Second, based on expert opinions there are 6 assumptions that must be made to conduct factoring for construction projects: reserve percentage, percentage of commission fee, advance rate, charging percentage for monitoring fee, recourse, and probability of payback by the contractor. In general, for a construction project, these are set as follows: $r = 10\%$; $f(x_i) = 3\% - 5\%$ annual rate; $Ar = 0.8$; $\phi = 0$; $R = 1$; and $P = 0$ where the nature of construction projects have higher risks to factors, who adopt factoring with recourse; and assume the contractor has 100% liquidating capability. The fees for the owner’s and contractor’s credit monitoring are considered a part of the factor’s corporate overhead. This does not appear in the contractor’s costs. Given that $Di = 30$ days and $N = 49$, Equation (3) for the contractor’s commission fee can be calculated as...
\[
\begin{align*}
\text{Max } f(x_i) &= \text{Max } \left[ \frac{Ar \sum_{i=0}^{N} f(x_i) \times p_i(1-r)}{\phi} \right] = $1,456,140 \\
\text{Min } f(x_i) &= \text{Min } \left[ \frac{Ar \sum_{i=0}^{N} f(x_i) \times p_i(1-r)}{\phi} \right] = $873,684 \\
\end{align*}
\]

where \( p_i \) is dependent of the actual activities completed during the \( i \)th period. For example, given \( i = 12 \), with a commission fee at 5%.

\[
\text{Min } \left[ Ar \times f(x_{12}) \times p_{12}(1-r) \right] = 0.8 \times \left[ 1 - \frac{0.05}{\phi} \right] \times 4,480,404 \times (1-10\%) = $33,311
\]

Notice that the calculation is based on daily compound interest rate. The account receivables is $4,480,404 \times (1-10\%)$ when the progress payment is \( i = 12 \). Using Equation (5), we can obtain the contractor’s costs caused by recourse

\[
R \times P \times \left( \sum_{j=0}^{N} p_j(1-r) + \sum_{k=0}^{N} p_k \right) = $0.
\]

In this case, the factoring agreement frames \( \phi = 0 \), because the monitoring fee is considered a part of the factor’s corporate overhead, yielding Equation (6)

\[
\phi \sum_{k=0}^{N} [\delta(y_k) + \epsilon(y_k)] = $0.
\]

Using Equation (7), we, thus conclude that the contractor’s costs for factoring account receivables for this project will range from $1,456,140 and $873,684 NTD. With respect to all project cash flows, Figure 3 demonstrates the cash flows in detail levered by factoring with 5% commission fee in comparison with non-financing cash flows.

VI. RESULT AND DISCUSSION

Class A and B construction companies in Taiwan are capable of performing this typical project; however the 13.34% of maximum funds needed can possibly cripple working capital management for both corporate and project finance, especially for the relatively smaller Class A and most Class B firms. Although using self-owned capital is more profitable, such firms may quickly run into fund shortages since they are required to carry out numerous projects annually so as to remain the current class. Or, they may need to carry a relatively large amount of working capital, which leads to idle capital or changes in the corporate capital structures. For a typical construction firm, the manager usually chooses alternatives that can level cash flows and effectively reduce capital gaps. Mitigating the capital gap usually requires loans, the most popular financial tool used in the construction industry. The typical annual interest rate for most corporate and project financing in Taiwan varies from 3% to over 10%, depending on the borrower’s credit. The annual interest rates of loans on favorable terms mostly lie in between 6.5% and 8.5% recently. Self-owned equity such as shares and stocks is even more expensive. A typical feature of these loans is that one-time basis crediting may not cover all funds needed for a project. Other loans or crediting processes may be required, and these cost the borrower extra time and money. On the other hand, loans are still the most commonly used sources of fund to fill project capital gaps.

In Table 1, it is implied that factoring is more cost effective than loans on favorable terms. Factoring also has advantages of facilitating financial management, instantly improving cash flow, enhancing investment efficiency, avoiding extra loan procedures, improving the credit rating, and financial risk transfer. The transfer of financial management tasks to a professional institution is an effective way to reduce work loads and internal costs of corporate and project administration. Cash flow volatility can be reduced two or more times, meaning better investment efficiency to the project and others. Repeating loan procedures to raise sufficient funds can be avoided. Financial risk is transferred partially from the contractor to the factor, because the factor rather than the contractor performs the collection task. These benefits however, can cost a medium-sized project 9.6% to 16% of the total profit margin. Costs may increase due to recourse if the contractor is not able to assure the factor of 100% payback. It is not suggested that factoring be applied to those projects where expected profit margins are low. There exists a credit limitation that excludes construction firms with relatively lower credit ratings.

Fig. 3. Project cash flows with factoring and non-financing.
Lowering financing costs and seeking other effective financing alternatives are an incentive to construction contractors. This study introduces the application of the factoring concept and mechanism to the construction financing field. Studies of the application of factoring in other industries and the features of construction projects are discussed and the contractor cost function is derived. A simulation with an empirical case illustrates that factoring is an efficient and effective tool to deal with project financing. It has the advantages of not only instantly improving cash flows, but also facilitating financial management, lowering financing costs, enhancing investment efficiency, avoiding extra loan procedures, improving credit ratings, and reduced financial risk. Ineffective use of working capital for a construction project that arises from applying other financing tools can be mitigated by using factoring. The contribution of this research are as follows: the introduction of a tool that improves project cash flows and reduces crediting procedures, the establishment of a cost function for factoring related to the contractor, the provision of a cost-effective financing tool under the guaranteed payback assumption when recourse occurs, and an alternative of financial risk transfer.

In future work it is suggested that the viewpoints of the other parties be considered and a more thorough theoretical structure be built. The function may be altered for other cost drivers. A deeper comparison between factoring and other financial methods could also be made. Such a comparison could facilitate discussion for a better financing environment. How factoring affects project cash flow is also of interest. This impact may exist in the interrelationship between the corporation and other projects. A decision-making model using hybrid concepts of financing can be established.

### REFERENCES


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