

Contractors' Pricing for Time-Related Contract Risks at the Tendering Stage

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Abstract

The contractors' pricing for contract risks in tenders determines how much the employers have to pay for the risk shifts, regardless of whether the risks materialize or not. Therefore, understanding the factors influencing the contractors' pricing for contract risks is crucial for employers to optimize the cost effectiveness of risk allocation in contracts.

This study investigates the factors that contractors perceive to be important when they are pricing 'time-related' contract risks and the relative importance of these factors with reference to previous studies on bid / no bid decisions and mark-up size decisions. Questionnaire survey is designed for the target list of government approved general building contractors to collect data from the Hong Kong construction industry.

The importance ratings are pre-defined by percentages of inflation / deflation in prices, so the scale of implication of the identified factors can be worked out. As a single factor may have two-sided implications (both inflating and deflating the prices) for which they can be in unequal scales, two extreme scenarios are introduced for each factor to examine its potential in pushing prices upwards and downwards. It is anticipated that two sets of importance ratings, one for inflating pricing and one for deflating pricing for time-related risks, will be worked out.

Keywords

Construction tendering, risk allocation, pricing decisions

1. Introduction

The construction industry in Hong Kong is dominated by keen competition driven by cost. To maintain competitiveness, tenderers may sometimes make inadequate allowances in tenders for additional costs due to possible delay in programme. Some other contractors may, on the contrary, choose to allow more possible delays in tenders as any underestimation may almost guarantee project loss due to the very low profit margin included. At the same time, employers would want to ensure that they can be best protected in a risk-free

position but with a reasonable cost. To study the cost effectiveness of such risk adjustment exercise, we have to examine the factors affecting the contractors' pricing for time-related risks, so that a more accurate assessment on the pricing can be worked out based on known tendering situations.

2. Statement of Problem, Objectives and Significance

Risk allocation through contractual provisions involves financial considerations. To enhance the cost effectiveness of risk adjustment, we have to assess the risk behaviors of both contract parties. Owing to the serious problem with project delays in the current construction market, time-related risks are focused on in this study. The most common time-related contract risk is the deletion of Extension of Time provisions in contracts (delay due to inclement weather is used as an illustrative example).

In measuring one's risk behavior, the traditional expected utility models tend to see people as rationally attempting to maximize their anticipated positive outcomes and minimize their negative outcomes. However, within this approach, we should adjust for risk perception and risk attitude to obtain one's subjective values. This is supported by empirical studies (e.g. Krzysztofowicz 1983a & 1983b, Keller 1995, Weber and Milliman 1997) showing significant differences between the expected utility and the subjective values. Some researchers have reported high correlation between attitude and behavior, but others have found only insignificant relationship. One piece of evidence is that we do not always act in accordance with our attitudes.

We can differentiate two approaches in improving the accuracy of predicting behavior from attitudes. One is concerned with the method of and the specificity in measurement, the other involves the investigation of "situational variables" that may increase the correlation between attitude and behavior.

The term "situational variables" is introduced here to fill the possible gaps between risk attitude and behavior, on the ground that such variables may not have any significant correlations with one's risk perception or attitude, but may relate to some other commercial decisions instead. Filling the gap between risk attitudes and behaviors requires the formulation of a model with substantial data input. However, we will only identify the factors and investigate their relative importance in this study. Against this background, the study objectives are:

- (a) to identify the factors influencing a contractor's pricing for time-related contract risks; and
- (b) to evaluate the importance of the identified factors in submitting a bid.

The identification of these factors and their importance imposes significance in studying contractor's risk behaviour in the bidding process and ultimately enhancing the cost effectiveness of risk adjustment exercise:

- (a) it helps build the model of investigating contractors' risk behavior when encountering time-related risks in the tendering stage; and
- (b) it equips employers with the knowledge of the processes underlying the contractors' risk behaviors, which are crucial if the employers want to intervene the contractors' risk behaviors (and thus the commercial offers for the works).

3. Survey on the Factors Constituting the "Situational Variables"

The identification of elements constituting the "situational variables" requires the reference to previous research studying the factors affecting bid / no bid decision and the factors affecting the markup size

decision. The relevant factors identified in these studies can serve as guiding stimuli in studying the factors affecting contractors' pricing for time-related risks.

Ahmad and Minkarah (1988) uncovered the factors that characterize the bidding decision-making process for the top general contractors in the USA and 31 factors were identified. Shash (1993) identified 55 factors influencing the bid decisions made by top UK contractors. Wanous *et al.* (2000) identified 38 factors that affected the bid / no bid decision of the contractors in Syria. Dulaimi and Shan (2002) also investigated the attitude of contractors towards mark-up size and the likely effect of contract size on such attitudes in Singapore.

Smith and Bohn (1999) had identified the factors increasing contingency mark-up, namely, workload, smaller contract size, increased project complexity, lower number of bidders, employer's poor reputation, tough bidder mentality, unclear contract documents and short bidding time frame, etc. Chua and Li (2000) identified risk, need for work, competition and company position as the significant factors to contractor's bidding decision. They also addressed the effect of the type of contract on bidding decision of contractors. These all could well be concluded by Wallwork (1999) which suggested that the bidding price was arrived at by the combination of detailed work, by an analysis of the bidder's own strength, needs and weaknesses, the particular circumstances of the project and by an assessment of the risk.

Previous researchers considered risk as one of the major factors affecting the bidding decision and the mark-up size. However, they had not studied adequately the factors affecting contractor's pricing for risks during the tendering stage. This is the literature gap to be addressed in this study.

4. Survey Methodology

4.1 Questionnaire Survey and Target Respondents

A review of the four selected research papers (Dulaimi and Shan (2002), Shash (1993), Wanous et al (2000) and Wanous et al (2003)) has been conducted, resulting in the identification of 46 factors, and these factors are generally considered relevant to the pricing of contract risks. This study relies largely on a self-administrative questionnaire survey on local building contractors and the factors included in the questionnaire are therefore developed from the literature review. In view of the possible differences in behavior among different sizes of contractors, the respondents will be classified into 3 groups (Groups A/B/C) in accordance with the List of Approved Building Contractors maintained by the Environment, Transport and Works Bureau of the Hong Kong Government.

4.2 Preliminary Study

A preliminary study with questionnaire survey (containing the 46 factors) and follow-up interviews with six local contractors have been conducted. The purposes of which are:

- (i) to test to what extent the factors identified in the literature can be applied in contractors' pricing for contract risks,
- (ii) to examine which factors applied in overseas countries do not apply in the local industry, and
- (iii) to investigate the factors that are particularly critical in affecting the contractors' pricing for time-related risks but may be insignificant in determining the bid / no bid or general mark-up decisions.

Following the preliminary study, the factors are shortlisted before their inclusion in the full-scale questionnaire survey. It aims to reduce the number of factors to around 30. To give a more organized questionnaire structure, the 46 factors are grouped under 7 categories as shown in Table 1.

Table 1. Factors Influencing Contractors' Pricing for Time-related Risks

Category	Factors	Category	Factors
Project Characteristics	<ul style="list-style-type: none"> • Size of contract • Project duration • Location of project • Project start time • Project cash flow • Degree of difficulty • Risk / safety hazard • Contractor's involvement in the design stage • Portion of nominated sub-contract works • Portion of domestic sub-contract works 	Contract Documentation / Administration	<ul style="list-style-type: none"> • Lump sum / remeasurement contracts • D&B / Traditional contracts • Completeness of document and design quality • Amount of liquidated damages • Risk in fluctuation in material and labour prices • Conditions / specifications • Insurance policies and surety bond • Contingencies allowed • Contract period
Employer / Project Team Characteristics	<ul style="list-style-type: none"> • Public / private client • Financial capability of the employer • Employer's reputation to honour payment on time • Coordination and administration skills of project team 	Bidding Situation	<ul style="list-style-type: none"> • Selective / open tendering (number of competitors) • Competitiveness of competitors • Tendering duration • Availability of other projects in hand • Bidding price
Contractor Related Issues	<ul style="list-style-type: none"> • Availability of required cash and office overhead • Need for work / current work load • Need for public exposure, marketing or establishing long term relationship with employer • Past experience in similar project / company strength in the industry • Past relationship with employer 	Economic Situation	<ul style="list-style-type: none"> • Availability of works in the market • Risk involved in investment • Rate of return for employers on the project • Availability and quality of supervisory persons / labour / materials / equipment • Labour union

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| <ul style="list-style-type: none"> • Relationship with sub-contractors and suppliers • Past loss / profit in similar projects • Confidence in company work force • Company's policy in production cost savings / economic use of building resources • Reliability and cost certainty in cost estimate | Social Problem | <ul style="list-style-type: none"> • Public objections • Government regulations and requirements on the type of works concerned • Tax liabilities |
|--|----------------|--|

4.3 Effects on Inflating and Deflating Pricings for Time-related Risks

A single factor may significantly inflate the pricing for time-related risks but it may pose insignificant effect on deflating the pricing. In view of the possible difference between a factor's effect on inflating and deflating a contractor's pricing for risks, two extreme scenarios are introduced for each factor, e.g. large project size v.s. small project size. By doing this, we can obtain two sets of importance factors, one in inflating prices and one in deflating prices. The order of factors in these two sets of measurements can be different.

4.4 Avoidance of Bias

In order to avoid bias, we ask the contractors to choose which factors inflate / deflate their pricings in lieu of providing a list of pre-defined items likely to inflate their pricing and another list likely to deflate their pricings for their importance rating. The contractors are asked to choose "+" or "-" or "0" to indicate whether they consider a particular factor may inflate, deflate or pose no effect on their pricing.

4.5 Pre-defined Scales of Importance

Merely working out the importance index gives little information to readers on how the factors actually affect the pricing for time-related risks, so the importance ratings are pre-defined by percentages of inflation or deflation to normal pricing (i.e. pricing in the absence of implications of situational variables). The five importance ratings account for a maximum of 100% inflation or deflation to the normal pricing, each in a 20% interval. Having a 100% deflation means that the contractor has entirely absorbed the cost of the assessed risks, whilst inflation of pricing can be more than 100%. However, it is expected that the scale of inflation seldom exceed 100% as inflating the price significantly will reduce the competitiveness of the tender. The adequacy of the 5-point scale will be reviewed after conducting the preliminary survey.

4.6 Structure of the Questionnaire

The questionnaire contains two main parts: Part one contains the list of factors (each with two sub-factors describing two extreme situations for which one should inflate the pricing and one should deflate the pricing). Respondents are asked to state "+/-/0" and to select a score from 1 to 5 to indicate the importance of these factors. Part two includes questions regarding the profile of the respondents and their companies so that the adequacy of experience in tendering of the respondents can be ensured.

4.7 Computation of Importance of Factors

The level of importance of the factors is assessed by calculating both an “importance index” and a “mean value”. The importance index can give readers an immediate understanding on the order of importance of the factors to contractors’ pricing for time-related risks, without taking into consideration the inflation and deflation effects. It also determines any differences among contractors of different sizes. The mean value, however, can provide the supplementary information on whether a factor inflates or deflates the pricing and to what extent as the scores are pre-defined by ranges of percentage of inflation / deflation. The higher the importance index and the mean value, the more important is the factor to contractors’ pricing for time-related risks.

The formula for calculating the importance index is borrowed from Dulaimi and Shan (2002), which states: Importance Index = $\sum aX \times 100/5$, where a is a constant expressing the weight given to each response, the weight ranging from 1 (least important) to 5 (most important). $X = n/N$, with n the frequency of the response and N the total number of responses.

5. Findings Obtained from the Preliminary Study

5.1 Data Analysis

The list of 46 identified factors was sent to six local contractors asking them to identify those items that were / were not their concerns when pricing time-related risks in tenders, and the valid factors were then rated in pre-defined scales. They possess 8 to 30 years’ experiences working in the industry and their posts range from quantity surveying manager to managing director of the firms. The five most important inflation and deflation factors are listed out in Table 2:

Table 2. The Highest Five Ranked Inflation and Deflation Factors in Pricing Time-related Risks

Inflation Factor				Deflation Factors			
Rank	Importance Index	Mean	Factor	Rank	Importance Index	Mean	Factor
1	40.00	+2.00	Poor financial capability of the employer	1	16.67	-0.83	Sound financial capability of the employer
1	40.00	+2.00	Very tight contract period	1	16.67	-0.83	Good employer’s reputation to honor payment on time
1	40.00	+2.00	Possibility to have public objections	2	13.33	-0.67	Urgent need for work / low to moderate current work load
2	36.67	+1.83	Poor employer’s reputation to honor payment on time	2	13.33	-0.67	Past experience in similar project / company strength in the industry
2	36.67	+1.83	Amount of liquidated damages being higher than expected	2	13.33	-0.67	Past / current relationship with employer

As viewed from the above results, contractors are more likely to inflate the pricing for time-related risks than to deflate the pricing, behaving as if they are more sensitive to unfavorable situational variables. The

scale of deflation is relatively small. Having a mean value of “-0.83” indicates that the implication of this factor is less than 20% of assessed normal cost (Score “1” is pre-defined as having an implication of 1-20% of the normal cost.).

Upon the receipt of the questionnaires, follow-up telephone interviews had been conducted with the contractors to gain a better understanding on why some factors were excluded from their consideration when pricing time-related risks and to have a preliminary assessment on their major concerns (i.e. what factors were most critical) in pricing risks so as to ensure that no major factors were missed out.

5.2 Applicability of the Identified Factors

The results revealed that 39 out of the 46 factors were agreed by three or more contractors as factors to be considered when pricing time-related risks. The remaining factors were not considered mainly due to the differences in situational variables between the local and overseas building industries. Besides, all six contractors considered the List conclusive. Therefore, the factors identified from the reference papers can largely be applied in local contractors’ pricing for time-related risks.

5.3 Differences between H.K. and Overseas Construction Industries

Some factors identified in the reference papers such as the presence of labour union and local customs, etc. were not considered by most interviewed contractors in the tendering stage. Unlike some overseas countries, the adverse consequences of these factors rarely took place in H.K. Besides, the following factors also seldom form part of the contractors’ consideration when pricing time-related risks in Hong Kong:

- Portion of works sub-contracted to domestic sub-contractors – This is due to the widely accepted extensive sub-contracting nature in the H.K. construction industry for which the Main Contractor only plays the management and coordination roles.
- Coordination and administration skills of project team – This is not normally known by contractors during the tendering stage. Besides, any change in personnel, which is frequent in the H.K. construction industry, may alter the whole situation, so the contractors do not normally consider such factor when pricing time-related risks.
- Relationship with sub-contractors and suppliers – Most contractors have developed good relationships with some sub-contractors and suppliers for whom they always sub-contracted with. Besides, the local construction industry is an open and competitive market, even working with a sub-contractor or supplier in the first time does not cause complicated procedures that involve much time implications.
- Selective / open tendering (no. of competitors involved) – This is quite surprising as it is a quite important, though not the critical factor identified in previous studies. Some contractors explain that as the local industry is a small and largely transparent market, they can almost guess who are their competitors based on the given project type and size. So, it makes little differences if the bid is taken out in selective tendering or in open tendering. Some contractors advise that they try to bid at the best offer each time if they do want the job, so the other’s submission of a lower price does not imply that they have rooms for further discount.

5.4 Factors Particularly Critical in the H.K. Construction Industry

As Hong Kong had encountered economic downturn in the past several years, turnover in property development had significantly reduced. Contractors of every tier tried hard to expand the client base in order to keep their business running. During the hard times, the successful bids could almost guarantee no or very little profit margins, so contractors’ cashflow became a serious concern. Under such situations, 4 out of the 6 contractors considered public exposure, marketing value and the need to develop long-term relationship with employers were under their considerations and all 6 contractors considered employers’

financial capability and their reputation of honoring payment on time as important factors determining their pricing decisions. The abovementioned factors did not gain very high importance scores in the reference papers, but they bear a considerable weighting in these 6 contractors' pricings.

5.5 Factors Particularly Critical for Pricing Time-related Risks

There is no doubt that time-related factors would pose more implications on pricing time-related risks. Therefore, the factors like "very tight contract period" and "amount of liquidated damages being higher than expected" constitute the major factors for inflating the pricing for time-related risks, but they are only moderately important in respect of bid / no bid decisions and mark-up size decisions.

On the other hand, there are some other factors which are important in influencing the bid / no bid decisions and mark-up size decisions, but are insignificant in pricing time-related risks:

- Lump sum / remeasurement contract – The contractors opine that the type of contract itself does not pose any influence on their pricing for time-related risks. Instead, they may adopt some strategies in pricing unit rates so that a higher final contract sum (but a lower tendered sum) can be arrived at.
- Contingency allowed in tender document – Most contractors believe that a larger amount of contingency allowed may reflect the intention to amend the design in later stage, for which such variations should be accompanied with the corresponding extension of time grants, so no extra time buffers are allowed.

5.6 Overview of the Results of the Preliminary Study

Employer's financial capability and their reputation to honor payment on time are critical in influencing contractors' pricing for time-related risks. This is supported by Smith and Bohn's (1999) survey which reveals that some contractors account for the employer as much as the work itself. Past experiences of working with the employers and rumors in the industry are also considerable justifications for adjusting risk buffers. Therefore, should employers want to obtain more competitive offers from contractors, they should pay attention to construct a better image so as to deflate the contractors' pricing for risks.

6. Conclusion

Undergoing the above-described selection process, 32 factors (each with two sub-factors) are shortlisted for inclusion in the full-scale questionnaire survey. They are highlighted in Table 1. Results obtained from the full-scale questionnaire survey can also be analyzed with demarcation on the size of contractors (Groups A, B and C), so that factors influencing the different groups' risk behavior can be identified.

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