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The motives for and consequences of

UNDERPRICING FOR CONSTRUCTION CONTRACTORS—EVIDENCE FROM AUSTRALIA

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ABSTRACT

Over the period of 2011–2013, there was a spate of bankruptcies of medium-to-large Australian construction contractors (many of whom were well-established), coinciding with a prolonged decline of the property market. Anecdotal evidence suggests that underpricing played a major role in the collapse of these companies and the financial misfortune of many major Australian construction contractors. On the other hand, anecdotal evidence also suggests that underpricing can be an effective tactic to penetrate markets or weaken competitors when used as part of a strategic mix—a double-edged sword. Because of the political sensitivity of the topic of underpricing, there has been a dearth of research in this area. This study investigates the extent and consequences of the practice of underpricing (in the Australian context), where it is defined as the submission of a tender price at a significantly lower level than the best estimate for the costs, profit margins, and risks of the construction project. Drawing from the literature on construction tender-price formulation, we develop a framework that separates the motives for underpricing into need-for-work and marketing-based competitive pricing; and predict the consequences of the practice of underpricing in terms of adverse financial consequence or profitability in circumstances driven by the two different motives. The framework is validated through data analysis based on a survey of the members of the Australian Institute of Quantity Surveyors and randomly selected large contractors. Underpricing was found to be prevalent in construction projects. Contributing to the literature, the results show that when underpricing is primarily driven by a contractor's need for work to maintain cash flow, underpricing contractors are likely to engage in deceptive practices, such as submission of unwarranted variations or reducing the standard of work. Further, the findings indicate that, although such deceptive conduct could lead to short-term relief of adverse financial outcomes, it does not contribute to the competitiveness of the company in the longer term. By contrast, underpricing driven by deliberate marketing strategies, such as market penetration or to weaken competitors, was found to be linked with long-term financial profitability of the contractor.

1. Introduction

During the period 2011–2013, there was a spate of bankruptcies of medium-to-large Australian construction contractors (*many of whom were well-established*), coinciding with a prolonged decline in the property market. Among the casualties, are prominent names such as: Kell & Rigby, St Hilliers Construction Pty Ltd, Hastie Group Limited, Southern Cross Construction, and Reed Construction Australia Pty Ltd. The issue caused so much concern about the broader impact of such insolvencies in the construction industry (*on the development of infrastructure and projects in the Australian State of New South Wales*), that the Government launched an independent inquiry into the matter in 2012.

Anecdotal evidence suggests that underpricing played a major role in the collapse of these companies and the financial misfortune of many big Australian construction contractors. In announcing the “Building slump claims another victim,” the Australian Financial Review declared that the “bidding war for the shrinking pool of work ... leaves scarcely any profit margin” (*Papadakis, 2012, p.44*). More directly, the article also referred to a BIS Shrapnel investigation which found that the “tightening market is forcing many builders to price jobs below cost.”

Surprisingly, there is a dearth of research on underpricing in the literature. There could be several reasons for this. It may be because of the political sensitivity of the topic, which attracts connotations of questionable practices. It may also be that normative logic suggests a cost-plus focus to sustain profitability. By contrast, intuitively, underpricing would seem to lead to an adverse financial outcome. Also, arguably, the single greatest challenge facing projects in most industries has been to increase efficiency and avoid cost overruns. Underpricing tends to be viewed as a cost estimation error rather than as an explicit strategy in itself.

To contribute to this research gap, this study investigates the extent and consequences of the practice of underpricing in the Australian construction industry context, with the aim of improving our understanding and ability to

manage the phenomenon in practice. In the study, underpricing is defined as the submission of a tender price at a significantly lower level than the best estimate for the cost, risks, and profit margin for the project.

While the marketing literature promotes competitive pricing, in line with strategic objectives such as market share or market penetration, results from this study suggests that aimless pursuit of “winning” contracts by underpricing could lead to adverse financial consequences. Drawing from the literature on the formulation of construction tender price, we develop a framework that separates the motives for underpricing into need-for-work and marketing-based competitive pricing; and predict the consequences of the practice of underpricing in terms of adverse financial consequence or profitability in circumstances driven by the two different motives. The framework is validated through data analysis based on a survey of the members of the Australian Institute of Quantity Surveyors and randomly selected large contractors.

The survey found that underpricing was prevalent in construction projects. Contributing to the literature, the study results show that when underpricing is primarily driven by a contractor's need for work to maintain cash flow, underpricing contractors are likely to engage in deceptive practices, such as the submission of unwarranted variations or reducing the standard of work, in order to recoup costs due to underpricing. It also shows that, although such practices could alleviate adverse financial consequences caused by underpricing, it does not lead to long-term profitability of the contractor. By contrast, underpricing driven by deliberate marketing strategies, such as market penetration or to win over a new client, was found to be linked with the contractor's long-term financial profitability.

In the following section, relevant literature is reviewed and the theoretical framework for the consequences of underpricing is developed. The research design is then elaborated and data collection and analysis processes are outlined. Following the presentation and analysis of results, conclusions are drawn and implications discussed.

2. Prior Research and Related Theory

Underpricing in tender bids in infrastructure projects is common in practice, yet it has rarely been directly studied in the published research literature (Flyvbjerg, Holm, & Buhl, 2002; Yiu & Tam, 2006). More typically, the literature has focused on cost overruns and cost underestimation, for which underpricing can be a contributing factor. For example, in examining cost underestimation, Flyvbjerg et al. (2002) consider four possible types of explanation: technical (*forecasting errors*); psychological (*appraisal optimism*); economic (*self-interest or public interests*); and political (*interests and power*). Their study finds in favor of the last two explanations (*economic and political*), to which they jointly refer as “strategic misrepresentation” (*that is, deception and lying*).

To understand underpricing and its effects on contractors and competitors, it is important to understand the pricing formation process for construction project tendering. Here, we focus on literature on the pricing formation process in the construction industry. Then, drawing from the economic and strategy literature, hypotheses on the effects of underpricing and associated motives are developed (*in the next section*).

As outlined by Akintoye and Skitmore (1992) and Assael (1985), the typical pricing decision process involves four steps: set pricing objectives, consider pricing-related factors relating to market position, select pricing strategy, and implement pricing.

Pricing objectives typically vary from maintaining cash flow, to maximizing profitability, to penetrating a market sector. Once the objectives are set, bidding organizations then proceed to analyze market positioning (*e.g., the number, quality, and competitiveness of other potential bidders*) to decide whether to bid and, if yes, what pricing strategy to use. There is a wide spectrum of factors affecting contractors’ bid/no-bid and pricing decisions. Factors include experience in similar types of projects, current workload, availability of qualified personnel, need for work, utilization of workforce, profit margin from similar projects, and market conditions (Ahmad & Minkarah, 1988; Shash, 1993; Fayek, Ghoshal, & Abourizk, 1999; De Neufville, Lesage, & Hani, 1977; Akintoye & Skitmore, 1990).

Pricing strategies vary from cost-plus, market-based, and value-based, to experience-adjusted pricing (Phillips 2005). Cost-plus pricing is based on cost estimates plus a mark-up, with no consideration for market conditions or strategic objectives. Value-based pricing identifies a contractor’s value proposition and tailored product/services and pricing to suit the client’s needs. In contrast, market-based pricing decisions primarily focus on market competition and strategic considerations on top of cost considerations. In practice, the

final tender price is often adjusted by senior managers based on their past experience on similar projects (Fu, Drew, & Lo, 2003).

The effectiveness of a particular strategy depends on its implementation (Nagle & Hogan, 2006). For example, collecting, tracking, and benchmarking previous tendering attempts over multiple projects assists pricing efforts and improves the pricing processes (Nagle & Hogan, 2006). There are many aspects and factors relating to pricing implementation. Since our focus is on pricing objectives and underpricing, we will not review, in-depth, the literature on pricing implementation.

The construction market in many countries is very competitive, where typical mark-up in the building construction sector can be as low as 7%. Construction companies procure work through competitive tendering (Dyer & Kagal 1996) in which the winner takes all. The predominant pricing approach in the construction market is cost-based (Mochtar & Arditi 2001), in which the contractor adds a mark-up to the cost estimate to form the bidding price. However, studies have shown that clients predominantly focus on cost as a selection criterion, where the lowest bid often wins. As a consequence, underpricing is common, or even necessary, to win contracts. The critical question is whether winning the contract using underpricing leads to the so-called “winner’s curse”—a double-edged sword—where the contractor wins the project, but makes below-par profit (*or even incurs a loss*) and risks its longer-term profitability.

Contractors that underprice their bids certainly do not intend to incur financial losses over the long term. There are three possible reasons for underpricing by contractors. The first is that the market is tight and the contractor needs to find work to maintain cash flow and keep staff employed. Under this circumstance, the profit margin for the contractor is likely to be below-normal or even negative. The contractor will do its best to recoup losses through various means—with one of the most common tactics being through variations.

In the context of infrastructure projects, Flyvbjerg et al. (2002) believe that strategic misrepresentation or deception is commonly used to win projects. This can involve underpricing and then recouping losses using deceptive techniques such as increasing claims for variations, reducing the quality of work, and/or taking advantage of poor project scoping (Mochtar and Arditi, 2001). Chan and Yeong (1995) and Smith and Bohn (1999) report that excessive variations may be falsified or manipulated to increase profitability or recoup costs from underpricing.

The second reason is due to mistakes on the part of the contractor, resulting in under-estimation of project costs. For example, the wrongly estimated project cost due to poor quality of historical cost data or inexperienced personnel. In this circumstance, the contractor is likely to bear the cost of underpricing. Nevertheless, this type of underpricing is unlikely to be repeated as the contractor is likely to learn from past mistakes.

The third reason for underpricing is market strategy, whereby the contractor deliberately underprices as part of a strategy to penetrate the market or weaken competitors. To enter an established market sector, a contractor often sets project margins deliberately (*and consistently lower than the market standard*) to outbid competitors entrenched in the sector. Despite the short-term prospect of minimal profit margin or even small loss, this strategy aims at securing a foothold in the sector with a view to growth and long-term profitability.

Economics further informs the pricing formation process (Yao, 1988) and the dichotomy created by underpricing. From a transaction cost perspective, the main transaction cost to the contractor is reflected by the extent to which the profit margin is below the typical return expected from similar projects. Underpricing effectively increases the transaction costs for all the contractors bidding for the project. If the decision to underprice is a strategy to secure work and cash flow for survival, the contractor is unlikely to have a clear picture of how to recoup costs from underpricing. In this circumstance, it is likely to engage in opportunistic behavior—more specifically, deceptive conduct—to recoup costs, most commonly through variations. Although such conduct could help the contractor to recoup some costs in the short run; in the long run, it is likely to damage the contractor’s reputation and relationship with clients, which is unlikely to sustain profitability in the long run. This internally-focused negative edge of the underpricing sword is likely to lead to market inefficiencies (Yao, 1988) and an adverse financial outcome. Alternatively, if the pricing decision is part of a strategy to penetrate the market sector for growth, or to make it harder for competitors to win contracts, then the contractor is likely to have analyzed the market and the possible consequence of underpricing, thus being confident about profitability in the longer run. One approach is to offset short-term profitability on a project with recurring profits from other business activities or other projects. This strategy has the potential to increase market share and longer-term profitability. This externally-focused market penetration strategy (*the edge of the underpricing sword*) can leverage market inefficiencies (Yao, 1988) to improve market position and generate longer-term profitability.

As mentioned previously, the building construction sector is highly competitive with thin margins. In such a market, underpricing can be a powerful competitive weapon to

undercut competitors and penetrate market sectors. However, the weapon is double-edged in that it could also damage the profitability of the contractor, at least in the short term, if not well managed.

3. Hypothesis Development

Based on review of the relevant literature above, **Figure 1** presents a high-level conceptual model for this study. It describes that motives for underpricing lead to different actions for recouping the costs from underpricing. If the motive is need-for-work, there will be an imperative for the contractors to recoup losses, often by engaging in deceptive/non-transparent conduct to mitigate adverse financial consequences as a result of underpricing. For a competitive pricing strategy, the motive is to penetrate the market or weaken competitors; there is no imperative to recoup the cost of underpricing from the focal project. If the contractor has done its homework, then the analysis would indicate how long the contractor could sustain the underpricing and the benefits that such underpricing could bring in the long run. If the analysis shows the consequences of an underpricing strategy are likely to be negative, the contractor will most likely reject the strategy. Therefore, the consequences for competitive pricing based on systematic strategic analysis are likely to lead to positive financial outcomes.

A study of UK contractors found that the top five factors affecting a bid/no bid decision are need-for-work, number of competitors, contractor experience for the particular project, current work load, and the client identity (Shash, 1993). A similar study of Canadian contractors found that the top three pricing objectives are to win the project, maximize the project’s profit, and meet turnover target or deploy idle resources (*need-for-work*) (Fayek et al. 1999). Unlike underpricing driven by competitive pricing strategy (*which focuses on penetrating the market or outbidding competitors with no emphasis on profitability of the focal project*), underpricing driven by need-for-work is likely to suffer losses with no recourse for recouping the losses from other projects because the contractor has committed its idle resources to the focal project. The only means to recoup the costs of underpricing is to engage in deceptive conduct (*such as to perform substandard work*), and dispute the contract in an attempt to improve the profit margin (LePatner, 2008). Hence,



FIGURE 1. Conceptual model

Hypothesis 1: Deception is significantly and positively influenced by need-for-work.

The consequences of deception have not been empirically studied. Anecdotal evidence suggests that it has been widely practiced. Therefore, it must have some benefit to the contractors engaging in this behavior. Contractors who are under contractor for work that is substantially under-priced are likely to perform substandard work and dispute the contract in an attempt to improve their profit margin (LePattner, 2008). The Industry Commission: Construction Costs for Major Projects (1991), agrees underpricing is inversely proportional to the quality of work, finding that there is a considerable tendency for contractors to perform work at a reduced quality to increase their profit margins. It has been seen in the Australian contracting environment that if the contractor's bid is too low, it may result in "excessive time delays and claims from the contractor ... in the hope of getting extra claims to compensate for the low price" (Chan & Yeong, 1995). Another study found that a contractor had even "manipulated change orders" to make up for lost profits in other areas of construction (Smith & Bohm, 1999). In addition, if the contractor is unable to fulfill the contract, this can add considerable costs and delays to projects in finding new contractors (Alexandersson & Hutten, 2006). The substandard work or deceptive conduct will damage the contractor's reputation in the long term and is therefore unlikely to contribute positively to the contractor's long-term financial health. Nevertheless, underpricing may be a technique for the contractor to recoup some costs, especially from inexperienced clients, thus mitigating its adverse financial outcomes.

Hypothesis 2: Deception mitigates adverse financial outcomes.

A contractor that persistently uses underpricing tactics to win projects is likely to experience adverse financial outcomes unless it can find alternative ways to recoup the costs of underpricing. Langford, Iyagba, and Komba (1993) analyzed the reasons for failures of selected construction companies during 1988-1993 and found that consistent cost and time overruns of projects were the main causes. Arditi, Koksal, and Kale. (2000) found that 26.71% of bankruptcies in construction industry failures were due to insufficient profit margin, which was attributed to the competitive tender environment,

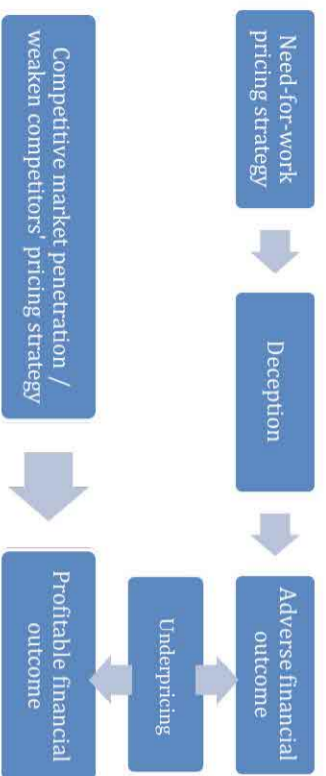


FIGURE 2. Research framework

the cost of variations claims, and the inaccuracy of cost estimates. Similarly, a study of construction business failures of 84 companies in Palestine found that reduced profit margins due to competition in the market played a significant role in company failures (Mahamid, 2012). Finally, Rwelamila, Lobelo, and Kupakuwana. (2004) found that within West Cape Province of South Africa, the main cause of insolvencies among civil engineering contractors was underpricing. Therefore,

Hypothesis 3: Underpricing contributes positively to adverse financial outcomes.

In contrast to need-for-work driven underpricing, competitive pricing strategy uses underpricing as part of the overall strategic mix to penetrate the market or weaken competitors. It focuses on the overall long-term profitability of the company and not the short-term profitability of the focal project. It is based on thorough analysis of the company's strategic position, not just the cost of the project or the immediate survival needs of the company. Therefore, underpricing driven by competitive pricing strategy is more likely to improve a company's long-term profitability.

Hypothesis 4: Underpricing based on competitive pricing strategy improves a company's profitability.

The research framework comprising the above four hypotheses is presented in **figure 2**.

4. Research Design

To empirically investigate underpricing, an initial study was conducted in Australia. A survey questionnaire was designed to test the hypotheses developed above using Survey Monkey. The study was conducted with employees of construction organizations employing more than 50 people in the Australian State of New South Wales. The employees surveyed had responsibilities in tender pricing, contract administration, project management, or upper-level management of a construction company. The request for completing the questionnaire was distributed to members of the Australian Institute of Quantity Surveyors in the Institute's fortnightly newsletter and to construction contractors with more than 50 staff and with typical projects worth more than US\$5 million. In total, 43 responses were received from employees of 14-30 organizations (not all respondents identified their organizations). Of the respondents,

nearly 80% were in a position to directly influence pricing strategy (37.2% were in estimating, 16.3% in quantity surveying, 18.6% in project management, 4.7% were in management, and 2.3% were in design), while the remainder were in contract administration (16.3%) and construction (4.6%). More than 50% of respondents were from construction companies with more than 500 employees.

The items in the questionnaire were designed to measure the key constructs and relationships identified in the hypotheses developed above. For each construct, **Table 1** lists the related survey questions. Cronbach's Alphas, and related literature sources. The Cronbach's Alphas indicate good reliability for the constructs deception and need-for-work (above 0.7), and acceptable reliability for the remaining two constructs (above 0.6 for exploratory studies). Multiple regression analysis was used to analyze the survey data. Hypotheses 1, 2, 3 and 4 are tested sequentially using the regression anal-

ysis. For example, the effect of Underpricing on adverse financial outcomes (Hypothesis 3) is tested by estimating Equation 1 (Assuming $\beta_2=0$). A significant positive β_1 supports Hypothesis 3. Dependent Variable = Constant + β_1 *Independent Variable 1 + β_2 *Independent Variable 2 + e Equation 1

5. Results

In this section, descriptive statistics are presented first; before the regression analysis results are explained. On the question of whether the respondent's last completed project was underpriced, 38.5% indicated underpricing. Re-enforcing this result, more than 75% of respondents perceived that the practice of underpricing in the New South Wales construction industry is prevalent.

On reasons for underpricing (see **Table 2**), the predominant reasons were "to win the bid" (73.5%) and "to maintain turnover/need-for-work" (72.3%); followed by "to maintain or build relationships with clients" (68.7%), "to take advantage of insufficient project scoping" and "occurred by accident" (56.9%). A marketing-based pricing approach ranked lower with "to penetrate the market" (52.7%) and "to weaken a competitor" (39.3%).

Regarding how the costs of underpricing are recouped (see **Table 3**), 72.7% answered "through other more profitable projects," 68% answered "through variations," 63.3% answered "increases in company efficiency," while 51.3% answered "reducing the standard of work."

On the consequences of underpricing (see **Table 4**), the top ranking was "loss of profit" (75.3%), followed by "disputes with the client" (68.7%), "financial distress" (64%), "maintaining cash flow" (61.3%), "improved relationships with the clients" (56.7%), and only a relatively small proportion of respondents indicated "financial gain at or above typical profit margin" (43.4%).

Constructs	Questions	Cronbach's Alpha	References
Deception	Motivated to underprice to take advantage of insufficient scoping; Losses from underpricing recouped through variation; Losses from underpricing recouped through reducing standard of work; Motivated to underprice to win the bid	0.83	Flyvbjerg (2005, 2006a, 2006b); Flyvbjerg et al. (2002); Flyvbjerg et al. (2003); Semiatycki (2009)
Need-for-work	Motivated to underprice to maintain turnover/need-for-work; Results from underpricing-maintaining cash flow	0.78	Blake Dawson (2011); Dulaimi & Shan (2002); Ling (2005); De Neufville & King (1991); Runeson & Skitmore (1999); Shash (1993)
Adverse financial consequences	Results of underpricing-loss of profit; Results of underpricing-financial distress; Reverse of results of underpricing at or above the margin	0.65	Arditi et al. (2000); Kangari (1988); Langford et al. (1993); Mahamid (2012); Rwelamila et al. (2004)
Competitive pricing strategies	Motivated to underprice to penetrate market; Motivated to underprice to weaken a competitor	0.62	Mochtar & Arditi (2001); Yiu & Tam (2006); Alexandersson & Hutten (2006); Oo, Drew, & Runeson (2010)
Last project was underpriced	Was your last completed project underpriced?	N/A	
Frequent project cost overruns	Did your company experience frequent project cost overruns?	N/A	

TABLE 1. Constructs

The regression analysis results are presented in **Table 5**. **Table 5** shows that Hypothesis 1 is supported—deception is significantly and positively influenced by need-for-work ($\beta=0.64, p<0.05$). Also evident from **Table 5** is that Hypothesis 2 is supported—deception mitigates adverse financial outcomes ($\beta=0.41, p<0.05$). Similarly, Hypothesis 3 is also supported—underpricing contributes positively to adverse financial outcomes ($\beta_{\text{isat project}}=1.00, p<0.01$). Finally, Hypothesis 4 is supported—underpricing based on a competitive pricing strategy is positively linked to financial gain at or above the standard profit margin, which improves a company's profitability ($\beta=1.24, p<0.05$).

6. Discussion

Consistent with literature and general perception, the findings indicate that underpricing in the construction market in New South Wales is widespread. Similar to the rankings of reasons for underpricing in other studies (*such as those of Fayek, Young, and Duffield (1998)* on the Australian construction industry; Fayek et al. (1999) on the Canadian construction industry; and Shash (1993) on the United Kingdom's construction industry); this study finds need-for-work and winning the bid as top considerations in sizing project mark-up in a bid or for underpricing.

Interestingly, while strategic underpricing is not widely used as a competitive tool, it has been shown to have a direct, positive impact on contractors' profitability. The plausible explanation for this phenomenon is that strategic underpricing needs to be backed by competitive advantages, such as cost advantage due to economy of scale and/or scope, relatively high sunk-cost, and/or high transaction costs for the competitors. This underpricing backed by competitive advantages is done in order to sustain (*possibly for a prolonged period of time*) lower than normal profit margins or even small losses (Yao, 1988). In reality, only a small proportion of contractors are in such advantageous positions. Further, this survey was undertaken during the second half of 2012, during a period of prolonged downturn in the Australian construction market when market conditions were conducive to needs-based considerations, rather than strategic considerations (Rimeson & Skitmore, 1999).

Need-for-work has been identified as one of the main reasons leading to deception or strategic misrepresentation (Flyvbjerg, 2005, 2006a, 2006b; Flyvbjerg et al., 2002; Flyvbjerg et al., 2003). A contractor driven by need-for-work is likely to engage in activities, whether deceptive or not, to recoup losses due to underpricing. Typical deceptive activities include taking advantage of insufficient scoping (Siemiatycki, 2009) or "having the costs underestimated and benefits overestimated" to get a project started as it "creates work for engineers and construction firms, and many stakeholders make money" (Flyvbjerg et al., 2002, p. 288). Such deceptive activities often lead to costly late design changes that can re-

sult in costly rework (LePattner, 2008). Adding to Flyvbjerg's concept of strategic misrepresentation, this study is the first to empirically identify need-for-work as an antecedent for deceptive conduct in construction tendering.

The research found that underpricing leads to adverse financial outcomes. Contributing to the literature, this study finds that deceptive conduct mitigates adverse financial outcomes in short term. However, deception does not contribute to above-average long-term profitability. Consistent with Rweilamila et al.'s (2004) finding that underpricing is a major cause of contractor insolvencies, this study finds that underpricing directly contributes to adverse financial outcomes. Further, we find that the frequency of project cost overruns in a company is directly linked to adverse financial outcomes for the company, supporting the arguments by Arditi et al. (2000), Kangari (1988), Langford et al. (1993), and Mahamid (2012), that persistent cost overruns erode profits and have a significant effect on the financial health of organizations.

This study also found that competitive pricing strategy is directly linked to financial gain at or above the typical profit margin, suggesting underpricing (*when used as part of an overall strategy to penetrate the market or weaken competitors*) can be an effective tool to improve company profitability. The finding is consistent with observations by Mochtar and Arditi (2001), Yiu and Tam (2006), Alexanderson and Hutten (2006), and Oo et al. (2010) that these market-based strategies are common in tendering and that it is profitable to target one's competitors.

Therefore, clients should be wary of the lowest bid in the tender process as there is financial motivation for the contractor to use deceptive practices against the client to maintain turnover. The client should be particularly wary if the contractor is experiencing low utilization of staff and difficulties in maintaining sales turnover (Blake Dawson, 2011; Dulaimi & Shan, 2002; Fayek et al., 1998; Ling, 2005; De Neufville & King, 1991; Oo, Lo, & Lim, 2012; Shash, 1993). For contractors, although deception can mitigate financial woes temporarily, it does not contribute to the long-term financial health of the company. To be profitable over the long term, it is important to develop a market-based strategy, and underpricing can be used as a component of the strategy. Underpricing motivated by a need for work tends to lead to deception and adverse financial outcomes and, therefore, should not be relied upon as the primary means to win projects.

7. Limitations and Future Research Directions

Caution should be taken when generalizing the findings of this study. This study is based on a relatively small sample and was conducted during a period of prolonged downturn in the construction market. Further studies should exam-

ine the issues in various markets with different market conditions to further validate the findings.

Further, the Cronbach Alphas for both constructs, adverse financial consequences and competitive pricing strategies are marginal for exploratory studies (>0.6). Future studies need to refine the instrument so as to improve the reliability of both constructs.

In this study, the dependent variables and the independent variables are measured via the same survey instrument. As a result, the findings are subject to common variance error (CVE). Future studies should mitigate CVE by collecting the performance data through different means such as company annual reports or stock market reports.

8. Conclusions

This study found that underpricing was commonly used to win projects in the New South Wales construction industry in 2012, during a period of prolonged downturn in the construction market in Australia. However, using underpricing is a double-edged sword. Need-for-work, as a main reason for underpricing, tends to lead to deceptive conduct to recoup losses from underpricing. Although underpricing can mitigate the financial woes of the company temporarily, it does not contribute to the long-term financial health of the company. In contrast, we found that when used as part of a strategic mix to penetrate a market, win a client, and/or weaken competitors, underpricing can be an effective tool to achieve profitability. Therefore, underpricing could damage or enhance the profitability of contractors depending on the objectives of underpricing, a double-edged sword in the hands of contractors.

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Reason for underpricing	Importance Index
To win the bid	73.5%
To maintain turnover/need-for-work	72.3%
To maintain or build relationships with clients	68.7%
To take advantage of insufficient project scoping	58.6%
Occurred by accident	56.9%
To penetrate the market	52.7%
To weaken a competitor	39.3%

TABLE 2. Reasons for underpricing

How the costs of underpricing are recouped	Importance Index
Other more profitable projects	72.7%
Through variations	68.0%
Increases in company efficiency	63.3%
Reducing the standard of work	51.3%

TABLE 3. How the costs of underpricing are recouped

Consequences of underpricing	Importance Index
Loss of Profit	75.3%
Disputes with clients	68.7%
Financial distress	64.0%
Maintaining cash flow	61.3%
Improved relationships with clients	56.7%
Financial gain at or above typical profit margin	43.4%

TABLE 4. Consequences of underpricing

Dependent Variables	Independent variables			R ²	N	
	Need-for-work	Frequentcy of cost overrun in participant's company	Last project of participant was underpriced			
Deception	0.64*			0.53	33	
Adverse financial outcomes		0.71*	1.0**	0.4	25	
Financial gain at or above standard profit margin			-0.41*	1.24*	0.34	27

* SIGNIFICANT AT THE 5% LEVEL, 2-TAILED.
** SIGNIFICANT AT THE 1% LEVEL, 2-TAILED.

TABLE 5. Regression analysis results



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references

Ahmad, I., & Minkarah, I. (1988). Questionnaire survey on bidding in construction. *Journal of Management in Engineering*, 4(3), 229–243.

Akintoye, A. S., & Skitmore, M. (1990). Analysis of UK tender price levels. *Transactions*, 34th Annual Meeting of American Association of Cost Engineers, Boston, MA, 71–77.

Akintoye, A., & Skitmore, M. (1992). Pricing approaches in the construction industry. *Industrial Marketing Management*, 21(4), 311–318.

Alexandersson, G., & Hutten, S. (2006). Predatory bidding in competitive tenders: A Swedish case study. *European Journal of Law and Economics*, 22(1), 73–73.

Arditi, D., Koksali, A., & Kale, S. (2000). Business failures in the construction industry. *Engineering, Construction & Architectural Management*, 7(2), 120–132.

Assael, H. (1985). Marketing management: Strategy and action, Boston, MA: Kent Publishing.

Blake Dawson. (2011). Scope for Improvement 2011: Project Risk—Getting the right balance and outcomes. Melbourne, VIC, AU

Borden, N. H. (1984). The concept of the marketing mix. *Journal of Advertising Research*, 24(4), 7–12.

Chan, A. P. C., & Yeong, C. M. (1995). A comparison of strategies for reducing variations. *Construction Management and Economics*, 13(6), 467–473.

Chan, S. M., Runeson, G., & Skitmore, M. (1996). Changes in profit as market conditions change: An historical study of a building firm. *Construction Management & Economics*, 14(3), 253–264.

De Neufville, R., & King, D. (1991). Risk and need-for-work premiums in contractor bidding. *Journal of Construction Engineering and Management*, 117(4), 659–673.

De Neufville, R., Lesage, Y., & Hani, E. N. (1977). Bidding models: Effects of bidders' risk aversion. *Journal of the Construction Division*, 103(1), 57–70.

Dulaimi, M. F., & Shan, H. G. (2002). The factors influencing bid mark-up decisions of large- and medium-size contractors in Singapore. *Construction Management & Economics*, 20(7), 601–610.

Dyer D. and Hagel, J. H. (1996). Bidding in common value auctions: How the commercial construction industry corrects for the winner's curse. *Management Science*, 42(10), 1463–1475.

Fayek, A., Ghoshal, I., & Abourizk, S. (1999). A survey of the bidding practices of Canadian civil engineering construction contractors. *Canadian Journal of Civil Engineering*, 26(1), 13–25.

Fayek, A., Young, D. M., & Duffield, C. F. (1998). A survey of tendering practices in the Australian construction industry. *Engineering Management Journal*, 10(4), 29–34.

Flyvbjerg, B. (2005). Policy and Planning for Large Infrastructure Projects: Problems, Causes, Cures. World Bank: Washington, DC, USA.

Flyvbjerg, B. (2006a). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245.

Flyvbjerg, B. (2006b). From nobel prize to project management: Getting risks right. *Project Management Journal*, 37(3), 5–15.

Flyvbjerg, B., Holm, M. S., & Buhl, S. (2002). Underestimating costs in public works projects: Error or lie? *Journal of the American Planning Association*, 68(3), 279–295.

Flyvbjerg, B., Skamris Holm, M. K., & Buhl, S. L. (2003). How common and how large are cost overruns in transport infrastructure projects? *Transport Reviews*, 23(1), 71–88.

Friedman, L. (1956). A competitive-bidding strategy. *Operations Research*, 4(1), 104–112.

Fu, W. K., Drew, D. S., & Lo, H. P. (2003). Competitiveness of inexperienced and experienced contractors in bidding. *Journal of Construction Engineering and Management*, 129(4), 388–395.

Hauser, J. R. (1984). Pricing theory and the role of marketing science. *Journal of Business*, 57(1), S65–S71.

Industry Commission. (1991). Construction costs of major projects. Report no. 8, 11 March 1991., Canberra: Australian Government Publishing Service.

Kangari, R. (1988). Business failure in construction industry. *Journal of Construction Engineering and Management*, 114(2), 172–190.

Kotler, P. (2000). Marketing management. New Jersey: Prentice-Hall.

Langford, D., Iyagba, R., & Kombi, D. M. (1993). Prediction of solvency in construction companies. *Construction Management and Economics*, 11(5), 317–325.

Lanzillotti, R. F. (1958). Pricing objectives in large companies. *American Economic Review*, 48(5), 921–940.

LePattner, B. B. (2008). Broken buildings, busted budgets: How to fix America's trillion-dollar construction industry. Chicago: University of Chicago Press.

Ling, F. Y. Y. (2005). Global factors affecting margin-size of construction projects. *Journal of Construction Research*, 6(1), 91–106.

Mahmoud, I. (2012). Factors affecting contractor's business failure: Contractors' perspective. *Engineering Construction & Architectural Management*, 19(3), 226–285.

Marr, M. V., Roegner, E. V., & Zwada, C. C. (2004). The price advantage. New Jersey: John Wiley & Sons.

McCaffer, R., McCaffrey, M. J., & Thorpe, A. (1983). The disparity between construction cost and tender price movements. *Construction Papers*, 2(2), 17–27.

Mochtar, K., & Arditi, D. (2001). Pricing strategy in the US construction industry. *Construction Management & Economics*, 19(4), 405–415.

Nagle, T. T., & Hogan, J. E. (2006). The strategy and tactics of pricing. New Jersey: Pearson.

Oo, B., Drew, D., & Runeson, G. (2010). Competitor analysis in construction bidding. *Construction Management & Economics*, 28(12), 1321–1329.

Oo, B., Lo, H. P., & Lim, B. T. H. (2012). The effect of bidding success in construction bidding. *Engineering, Construction and Architecture Management*, 19(1), 25–39.

Papadakis, M. (2012, November 15). Building slump claims another victim. *Australian Financial Review*, 44.

Phillips, R. (2005). Price and revenue optimization. Stanford, CA: Stanford University Press.

Porter, M. E. (1996). What is strategy? *Harvard Business Review*, 74(6), 61–80.

Runeson, K. G. (1988). Methodology and method for price-level forecasting in the building industry. *Construction Management & Economics*, 6(1), 49–55.

Runeson, K. G., & Skitmore, M. (1999). Tendering theory revisited. *Construction Management & Economics*, 17(3), 285–296.

Rwelamila, P. D., Lobelo, L., & Kupaku-wana, P. S. (2004). Insolvencies among civil engineering enterprises in South Africa: A time to reflect. *Cost Engineering*, 46(7), 12–14.

Shash, A. A. (1993). Factors considered in tendering decisions by top UK contractors. *Construction Management & Economics*, 11(2), 111.

Siemiatycki, M. (2009). Academics and auditors. *Journal of Planning Education and Research*, 29(2), 142–156.

Skitmore, M. (1991). The construction contract bidder homogeneity assumption: An empirical test. *Construction Management and Economics*, 9(5), 403–429.

Skitmore, M., & Runeson, G. (2006). Bidding models: Testing the stationarity assumption. *Construction Management & Economics*, 24(8), 791–803.

Skitmore, M., Runeson, G., & Chang, X. (2006). Construction price formation: Full-cost pricing or neoclassical microeconomic theory? *Construction Management & Economics*, 24(7), 773–783.

Skitmore, M., & Smyth, H. (2007). Pricing construction work: A marketing viewpoint. *Construction Management & Economics*, 25(6), 619–630.

Smith, G. R., & Bohn, C. M. (1999). Small to medium contractor contingency and assumption of risk. *Journal of Construction Engineering and Management*, 125(2), 101–108.

Smyth, H. J. (2000). Marketing and selling construction services. Oxford: Blackwell Science.

Stone, P. A. (1983). Building economy: Design, production and organization: A synoptic view. Oxford and New York: Pergamon Press.

Wanous, M., Bousabbaine, A. H., & Lewis, J. (2000). To bid or not to bid: A parametric solution. *Construction Management & Economics*, 18(4), 457–466.

Yao, D. A. (1988). Beyond the reach of the invisible hand: Impediments to economic activity, market failures, and profitability. *Strategic Management Journal*, 9(1), 59–70.

Yiu, C. Y., & Tam, C. S. (2006). Rational under pricing in bidding strategy: A real options model. *Construction Management and Economics*, 24(5), 475–484.