Construction Project Tendering in China : An Exploration of Theory and Practice relating to Article 33 of China's Tendering Law

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ABSTRACT

Recently (1999) China introduced legislation to control tendering for construction projects as an element of transition to a market economy. Article 33 'outlaws' tenders below cost but, unfortunately, cost remains undefined. This paper analyses what the term cost may mean and how costs are forecast and prices determined in the construction industry operating in competitive market economies. It is evident that interpretations are numerous and varied. Procedures commonly employed by the industry are based on heuristics and represent stochastic processes in, often misleading, deterministic terms. Usually, such simplifications go unrecognised and so, their consequences are ignored except when manifested as problems. On the basis that the tendering legislation in mainland China seeks to assist transition of the domestic industry from a command economy to a market economy, whilst ensuring competitiveness and assuring project performance, the paper concludes that a 'minimum price parameter' accompanied by bonding, could be employed, using currently available data, processes and expertise.

KEYWORDS

China, Cost, Economic Rationality, Tendering

INTRODUCTION

As China moves progressively to operating as a free market economy, there is increasing attention to effectiveness and efficiency. A critical element is to secure the advantages of competition, both price and non-price, whilst avoiding disadvantages and problems. In a world attaching ever more importance to visibility / transparency of procedures, devising appropriate systems is a sensitive and difficult task.

Commonly, communities endeavour to control market structures through enacting anti-monopoly, or anti-trust, legislation. Such statutory provisions may be reinforced by further legal measures to promote competition – most commonly, concerning price competitive bidding for public sector supplies. The underpinning assumption, really a politically-generated assertion, is that by ensuring competition, the 'best deal' is secured. Even if non-price factors are scrutinized in pre-bidding evaluations, with the objective of ensuring the only factor to significantly differentiate the bidders from the purchaser's perspective is bid prices, certain problems remain due to the price competition's being on bid price only whilst opportunities (n.b. variations, 'claims') exist for increasing the initial price to the final (outturn) price. Such opportunities can distort prices bid, depending upon the perceptions of the bidders and their preparedness to act upon them in determining the price to bid (Rooke, Seymour and Fellows, 2003).

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In an endeavour to engender stability and to avoid problems in changing from a command allocation system to a (bid) market price allocation system, China has passed laws relating to competitive tendering. In particular, Article 33 stipulates that "The tenderer shall not be allowed to offer a price less than cost". That law has prompted considerable discussion and is examined in this paper.

A particular problem remains the 'image' of how the authorities in China are attempting to ensure reliability, appropriateness and transparency in controls of the economic transitions. The issues are epitomised by the American Chamber of Commerce (2002), *"New tendering and bidding regulations have not been widely adopted and lack enforcement power. Many organizations resist implementation, and as a result, corruption remains a significant problem behind the continued lack of transparency of current tendering and bidding procedures."* Wang, Fang and Lin (2003), for example, provide support for the perception and note that,*" common means is offering a below-cost price to win the contract and then seeking unethical profits by modifying the design to change the unit price or work quantity in Xiamen, a bidder once won the contract by offering a price which was about 46% of the base price"*. Corrupt price manipulations with subcontractors occur also, resulting in poor time performance and low quality. The usual practice of the designers' calculating an official 'base price' for a project (a prediction of the suitable low bid using official price data) is being amended in moves towards market orientation – since 1 July 2003, Beijing has employed an itemised valuation system instead of 'base price' (China Today, 2003).

THEORY BASES OF CONSTRUCTION PROJECT TENDERING

Economic Rationality
Much economic theory is founded upon the assumption of rational human behaviour – that individuals act to maximize personal satisfaction and firms act to maximize profits. A development to generalize the theory is that behaviour of economic agents has the primary objective of maximizing their utility.

Baumol (1959) examines the consequences of the separation of ownership and management as occurs in most larger companies. He notes that whilst the behaviour of owners is described well as being directed towards profit maximization, the behaviour of managers is characterized as revenue maximization. Hence, Baumol concludes that the behaviour of the modern company is described best as pursuit of revenue maximization subject to a minimum profit constraint.

Hutton (1996) documents the requirement common in Western stock markets for companies to produce, at least, non-decreasing streams of dividends, irrespective of prevailing economic conditions. A supplementary requirement is for the market value of the companies to be preserved in real terms. Hence, there remains major pressure on companies to pursue profit.

Neo-classical economic theory indicates that a firm must earn normal profit as a long period minimum requirement for survival. Normal profit is the minimum return required by the (average) owner of the firm to keep the investment in that firm and is assessed as compensation for risk-bearing etc. As market conditions, including financial markets, become increasingly turbulent (due to interactions, globalisation and so on), levels of normal profit fluctuate also. Further, corporate financing employs ever greater diversity of sources and 'financial products' and, taking taxation legislation into account as well, firms are concerned with (growth in) market share and profit; and thence, dependent upon their capital structuring, their return on capital employed (profitability).

In construction project tendering, the participants include clients, designers and main contractors, (plus suppliers and subcontractors). Normally, clients are drawn from a wide

variety of companies and government agencies whilst main contractors (tenderers) are usually companies. Therefore, behaviour of the array of parties to construction project tendering may be explained and analysed by the economic theory, discussed above. However, such behaviour is likely to be subject to satisficing / bounded rationality in making decisions (Simon, 1957) and opportunism (Williamson and Maston, 1999).

Values, Costs and Prices

Much theory of value is derived from the labour theory initiated by Smith (1970), developed by Ricardo (1971) and extended by Marx (1946) which asserts that only human labour (power) generates value.

Whatever basis of value accumulation and ownership is adopted, it is apparent that two elements are important in determination of market-based transactions: the utilities of the subject matter as perceived by the potential vendor and the potential purchaser, and those parties' conversions of such subjective use values into parametric (monetary) exchange values to determine whether a transaction is feasible. If a feasible region emerges, then the exchange value at which the transaction occurs (the monetary cost to the purchaser and the monetary revenue – price – to the vendor) will be determined by the negotiating powers and skills of the parties.

Clearly, the perspective is founded on the basis that, via subjective conversion, utilities are translated into money amounts, which, then, can be used as a common (universal) measure. However, a further, and critical, concept is that such valuations also represent resource embodiments so that money becomes a surrogate measure of real content (uses) in goods and services (hence, the widely-assumed model of trade-off between unit cost and quality, and / or time) and, thereby, is representative of opportunity cost.

Under market economic theory, whilst firms must earn normal profit as a minimum for survival in the long period, in the short period, a transaction is rational provided the exchange value covers the supplier's marginal costs at least. In a free market, firms will endeavour to maximize profit (subject to the considerations, noted above) whilst in a command economy, the governing authorities will allocate resources etc. and determine the parties to any transaction, its timing and the exchange value. In either (extreme) situation, the long period requirement is for total costs of the supplier to be reimbursed via exchange value to ensure sustainability – it is the short period situations in which notable differences occur, thereby calling the role of total cost into question as a necessary determinant of price.

Competition Theory

Commonly, competition analysis is founded on consideration of structures of markets as those are believed to determine behaviour of the actors and, thence, performance; the best known market structure is the (theoretical) perfect market. At the other extreme of the market structure spectrum lies monopoly and its demand side counterpart, monopsony. Although perfect markets do not exist in practice, but all other structures do, the perfect market forms a common, idealised basis on which much analysis, and politico-economic rhetoric, rests due to the perceived allocational and operational efficiency and effectiveness, notably, Pareto efficiency.

The structure-based analysis examines the market share of occupant firms, through % value of sales of each firm or group of firms. Concentration (ratio) concerns the aggregate market share of the four largest firms and so, denotes the degree of horizontal market power. Boundary analysis examines the barriers to entry / exit of firms – this concerns 'marginal firms', both actual and potential. Effective competition occurs where no firms have a market share which is large enough to give them strong influence over others, especially in respect of pricing, and barriers to entry are

small. Thus, many traditionally-oriented models relate to the notion of effective competition by analyzing the elements of market competition external to a firm (e.g. Porter, 1990) whilst 'contestable markets' (e.g. Baumol, Panzar and Willig, 1982; Button, 1985) concern sunk costs of entry as the barrier to expanded (numerical) competition through which the *shadow* of increased competition acts to suppress the profit-seeking behaviour of incumbent suppliers.

Under oligopoly, especially tight oligopoly and / or one where there is a dominant (usually price-leader) firm, it is easy for the firms to cooperate on pricing and market share allocations. Although, generally, the subject of anti-monopoly / anti-trust legislation, if formalized (as in cartels), there is much to suggest that instances of tacit agreements are common – indeed, are a natural consequence of rational organizational behaviour. The neo-classical economic analysis of equilibrium under oligopoly, employs the kinked demand curve being produced as a composite of the market share and particular demand curves, demonstrates its position as a static analysis in which moves from the equilibrium are considered. That may be examined, alternatively, in terms of Cournot and Bertrand equilibria in which the particular oligopolist determines its action, given the output quantities and prices of the other oligopolists.

Such analyses lead (e.g.) Lipsey (1989) to discuss the hypothesis of qualified joint profit maximization as the driver of the behaviour of oligopolists who are subject to two sets of economic forces – one advocating individual profit orientation, and the other profits of the group of firms. The underpinning tenet is that the oligopolists recognise their interdependence, especially in terms of pricing behaviour and, consequent, profits, given that such firms are likely to be of similar efficiencies, technical competence etc.

For analysis of construction project competition, the usual forms encountered comprise monopolistic competition (competition amongst the many) – as in open tendering – and oligopoly (competition amongst the few) – as in single stage selective tendering. The two market forms show differing levels of monopoly power and so, different bidding behavioural characteristics.

Construction Project Tendering – Models and Accuracies

Apart from development of codes of procedures for obtaining and producing tenders (e.g. NJCC, 1996), the other main stream of investigation has concerned the bid to be submitted to obtain a project and the consequent profit. The codes have been developed to protect clients / employers by endeavouring to provide procedures of constructor examination which should, if followed, yield a realistic, competitively low price as well as assured performance of the construction operations. Although of undoubted assistance in achieving the twin objectives, significant problematic aspects remain, some of which may be addressed only subjectively when potential constructors are being scrutinised (on their records of performance, financial security etc.). Thus, opportunistic behaviour, via front-end loading of bids etc. and revenue enhancement (scrutinising tendering documents for likely variations / change orders and for possible claims) remains extensive. The result is that final accounts (outturn prices) are usually above accepted tender sums by several percentage points, even on small, straight-forward, firm price projects; projects involving novel operations, innovations etc. may be subject to huge price escalation from initial to final contract sum.

Bidding models of projects began with Friedman (1956). The model concerned calculation of the probability of a contractor winning a bidding competition for a project by submitting a given bid against either a known number of known competitors or against a known number of unknown competitors. That model was criticised and amended by Gates (1967) who offered an alternative mathematical model. Willenbrock (1973) considered utility factors in bidding and adopted a decision tree approach. Carr (1982)

produced a complex model in endeavouring to obtain universal applicability which, as Willenbrock's, was based on the ratio of the particular contractor's bid: estimate, he concluded that "Expected value is not very sensitive to small changes in markup because each adjustment in markup is counter balanced … by a shift in probability of winning. This allows for adjustment in markup to level the workload, or to receive an adequate return on investment, without much change in expected value." Further discussion of bidding models is given in Skitmore (1989).

Those models focus on mathematical modelling regarding the level of bid (or markup) and the probability of winning the project at that bid. Fine (1975) provides a simple analysis to enable a contractor to examine its appropriateness of market judgements in bidding from its own (and public domain) data. Further Fine, and Harris and McCaffer (2001), calculate and chart percentage markups for contractors to apply to achieve break even (over a large number of projects) when competing against different numbers of competitors and having different levels of accuracy in their estimating.

A number of further studies, notably Ahmad and Minkarah (1988), Shash (1993), have sought to determine hierarchies of factors which influence contractors' bid – no-bid decisions as well as those which influence the level of markup to apply when bidding. Other studies investigate an array of factors likely to impact on bid levels and competitiveness (e.g. Drew and Skitmore, 1997).

Related investigations have sought to analyse the accuracy of tender price predictions made during the design period, usually by consultant quantity surveyors. Morrison's (1984) investigation went somewhat further than many others in quantifying not only the accuracy achieved but also the constituents of the overall prediction error. Bennett, (1982) found that the coefficient of variation (cv) of errors (forecast by QS during design: lowest acceptable bid) varied from 22.5% at early design stage to 6.5% at just prior to receipt of tenders; the

improvement can be attributed to the greater detail of project-precise information and to the increased sophistication of the forecasting methods used in later design stages. Ashworth and Skitmore (1983) found the 6.5% cv to be applicable to different project types and sizes over a range of countries.

PRACTICES IN CONSTRUCTION PROJECT TENDERING

Work Allocation

Price competition is the most common work allocation mechanism, and so, price determination methods are the focii of procedures. That approach is questionable, due to the importance of time performance (especially of constructors) (NEDO, 1983; 1988) and quality performance considerations. Adopting the project performance criteria of cost, time and quality, the issue becomes what are the relative importances in making performance-impacting decisions? That, of course implies the traditional trade-off model of interaction of those criteria rather than the 'Toyota' model, as in 'lean production' and 'lean construction', continuous improvement firm (cif) etc. (see, for example, Womack, Jones and Roos, 1990).

For major construction projects, the usual allocation method is single stage selective tendering (as NJCC, 1996). However, industry practice is increasingly to introduce variants to supplement the standard procedures. Common variants involve:

(1) Submission of priced BQs with the tenders.

(2) Submission of CVs of key personnel whom the tenderer will employ on the project, if the work is allocated to that tenderer.

(3) Interviews of the low bidding tenderers' (2-3 organisations) key personnel on how the project will be managed, if the work is allocated to that tenderer.

(4) Submission of work execution programme

(in a prescribed format and level of detail) to become a contract document with an obligation on the successful tenderer to maintain the programme up-to-date during the project execution.

The purposes of varying the standard procedures are:

(1) To further reduce the potential for collusion / manipulation of pricing - and, hence, the award of the work after submission of tenders through obtaining knowledge of other tenders and amending the price component details as in the BQ.

(2) To enable initial judgement of the expertise to be employed in managing the project and, hence, the potential performance at a more exact level than judging the past performance of the tendering organizations.

(3) In extension of (2).

(4) To facilitate more control over time and to assist evaluations of time-performance consequences of decisions (and claims) as well as facilitating (discounted) cash flow evaluations of tenders.

By carrying out a more extensive evaluation of project execution intentions, the client, and consultants/advisors, are able to obtain not only a more holistic view of likely performance but should be encouraged to examine further the criteria for project performance and the relative importance of each. Additionally, by interrogating the relationships assumed to exist between those performance variables, they should make better (more accurate/informed) decisions over project contents (variations, programming etc.) and so, gain a more accurate set of expectations.

Price Determination Variables
The usual model for determining the price for construction of a project is:

Price = Cost + Mark-Up.

That model is a vast over-simplification. Even accepting the economic performance objective of profit maximisation as the sole (or dominant) objective of business units, just the perceived operation of (price) competitive tendering with work awarded to the lowest tenderer, leads to modification of the model. However, for long period analysis, and given that firms in the private sector have survival as an imperative, the minimum revenue they must earn in the long period must exceed their total costs by 'normal profit' at least - hence, the notion of 'normal profit' as a quasi cost. Whilst that consideration is vital, it is determined by realisations of financial flows; whereas pricing is a predictive activity, such that the model should be revised to be:

Price = Forecast Cost + Mark-Up.

As noted, above, short period economic analysis asserts that the minimum rational price, from a predictive stance, is forecast marginal cost. In neither the short period nor the long period is there a maximum price; however, each tenderer is likely to assess a maximum applicable price which is dependent upon whether, and to what degree, the firm desires to be awarded the project and their evaluation of competitors' likely tenders. The maximum price to tender, for a firm which wants to be awarded the project, is below the (firm's forecast of the) lowest competing tender by the smallest possible ('safe') amount. Thus, provided the firm forecasts that such maximum price exceeds the marginal cost, it is that pricing consideration alone which determines its tender sum!

However, in exceptionally buoyant economic conditions for tenderers, they may endeavour to forecast the maximum price which the buyer would be willing to pay and so, bid up to that sum (as profit maximising behaviour). In such conditions, each tenderer will not be very anxious to win the project as workloads of firms are high (as are prices – which are likely to 'pull up' costs too); consideration of consequences of tendering behaviour on (longer period) relationships with

buyers and their agents remains a likely mitigant of such profit seeking / opportunism.

Understanding mark-up to be in respect of profit only, attention can turn to examination of cost forecasting aspects of price determination. Both design and construction are service activities and so, employ cost accounting approaches to price determination hence, the emphasis on estimating.

Consequences of adopting deterministic forecasting when, in reality, stochastic processes are operating – as for construction costs and prices – are epitomised by Reugg and Marshall (1990). They characterise construction project price forecasts as 'best-guess', conglomerate estimates of input variables but treated as certain estimates with results presented in single-figure, deterministic terms. That approach portrays the forecasts as being both precise and known (i.e. of zero inherent variability and absolutely accurate – zero error). Given the processes concerned, data measurement (recording), data selection, forecasting methods, and inclusion of human judgments in adjusting for different conditions etc., that usual practice is fundamentally flawed. An important consequence of such flaw is that the portrayed certainty, by its very nature, acts to disenfranchise decision makers by masking the variabilities and, hence, appreciation and investigation of what moves the forecasts, how, why, to what degree etc. Thus, in cost / price terms, there is likely to be less effectiveness and less efficiency – so, reduced 'value for money'.

Selection of items of data to use, adjustments etc. are human activities and so, are likely to be subject to errors – both systematic and non-systematic. [For a discussion of such errors, see Kahnemann, Slovic and Tversky, (1982) and, regarding construction, Al-Tabtabi and Diekmann, (1992); Fellows and Liu, (2000).] However, although errors for individual activities' costs may be quite large, provided the errors are not systematic and large, regression to the mean / central limit theorem effects will render the aggregate error to be relatively small.

In respect of estimating cost of materials – potentially, the most straight-forward resource to cost forecast – Skoyles (1978; 1981) found that the 'waste' factors employed in UK were, on average, only 50% of the waste factors experienced in practice. The consequence is likely to be that the estimate for a typical building project would under-forecast the cost by about 3% – a significant amount, given the level of profit mark-up applied by contractors, thus, errors in estimating are important but, often, unknown.

Gray (1983) investigated pricing of the preliminaries items ('site overheads') in UK bills of quantities (BQs) and found that about 6 items usually constituted 90% of the total price of the preliminaries section of a BQ. Costs of those items would be estimated in detail but prices allocated to many other preliminaries items would be lump sum 'guesstimates'. Research by Bennett (1982) noted that preliminaries usually constituted 15-18% of contract sum on large building projects; however, on small, repair projects they could total as much as 80% of a contract sum. [The equivalent costs can be deduced.] It is understandable that preliminaries items are used for 'last minute' bid price adjustments but with scant regard for consequences for delay cost reimbursement claims etc.

It is well-known that no BQ is a truly accurate measure of the project components, even in the absence of variations. Commonly, contractors add contingency sums to forecast costs and prices to allow for 'risks'. Although, statistically appropriate, those sums will be incurred on some projects, be exceeded on some and merely add to profit on others. Further, projects may be subject to uncertainties (as well as risks) which, by definition, can be assessed only subjectively. Hence, adopting an organisational, long period perspective, total costs (forecast to be or actually) incurred include such risk contingencies (assuming forecasting accuracy), the individual project / short period perspective yields a different result – dependent upon what occurs on the project / during that short period.

Additionally, prices, if not costs, may be

forecast taking opportunities for submission of 'claims' into account (see, e.g. Rooke, Seymour and Fellows, 2003) and for post contract downward negotiation of subcontractors' and suppliers' quotations which were used to assemble the bid. Those are clear manifestations of opportunistic, profit seeking behaviour (see, e.g., Williamson and Maston, 1999). Incentives for such behaviour are greater in a 'buyer's market' due to the downward pressure on bid prices.

The general overheads of firms are usually 'absorbed' into project cost forecasts. That process operates on a cost accounting basis in which prior periods' recorded overhead costs are used to predict the level of overhead costs for the forthcoming period, incorporating adjustments for envisaged changes. Bases for allocation of those overheads to outputs are determined and measured (e.g. direct costs of all projects over the accounting period used – usually, one year) and, subject to adjustments for historic variances.

Changes in structuring of the construction industry in many countries continues to witness the increasing incidence of subcontracting – in more extreme cases, main contractors carry out no construction activities but manage and service (provide attendances on) subcontractors. Such structural changes echo the general movement to 'core business' and the means of securing cost reduction through flatter structures of firms and, hence, reduced overheads (given approximately common technical efficiencies and costs amongst competitors). Pricing, then, focuses on assembling and adjustment of subcontractors', suppliers' and plant hire bids. Those bids constitute contractors' initial cost forecasts (potentially subject to later adjustments / manipulations) which the subcontractors may submit differentially to main contractors, thereby endeavouring to influence to which main contractor the project is awarded (see, e.g., Uher, 1990).

DISCUSSION OF ARTICLE 33 OF CHINA'S TENDERING LAW

Construction Project Tendering in Mainland China

Following declarations regarding economic reforms to move towards a market economy, mainland China (re-)introduced tendering in 1978. Previously, all construction projects were allocated to construction organisations by the government. The Ministry of Construction (MOC) issued Recommendations on Contracting Capital Construction Projects in 1979 – those were implemented first in Shenzhen and, later, in other cities.

Commonly, mainland China uses either open or single stage selective tendering for the competitive award of construction work with both local (increasingly privatised) and / or international contractors being the tenderers. Although open tendering is commonly advocated as a means by which integrity of bids may be assured, it remains subject to inefficiency problems, as noted by (e.g.) Banwell (1964).

For procurement by government in China, Article 17 of the Government Procurement Law of the PRC (effective 1 January, 2003) states, "…the procurement price be lower than the average market price, that procurement shall be more efficient, and that good quality goods and services are procured". That statement requires the 'best of all worlds' to be achieved – the reference to the average market price necessitates private sector prices to be above those in the public sector – likely to be a significant problem, especially if no comparable private sector demand exists (as for infrastructure projects)!

Objectives and Problems of Article 33

Article 33 of the Tendering and Bidding Law applies in conjunction with a variety of further provisions, notable among which are the following:

Article 26 – "A bidder shall have the capacity to undertake the project..."; required qualification may be specified in the tender documents.

Article 27 – "...a construction project, the contents of the bid documents shall contain the profiles and business performances of the persons-in-charge of the project and major technical personnel to be appointed as well as machinery and equipment to be employed...".

Article 28 – "...*If the number of bidders is less than three...issue the tender anew...*", as is common for public sector projects, universally.

The rationale behind the content of Article 33 is to endeavour to avoid problems which are notoriously consequent on "buying work" by constructors but, as noted above, that term may be interpreted in alternative ways. So, following the specific statement in Article 33, the question at issue is, 'What is the meaning of "*COST*"'?

Cost may be total, average, marginal; direct, indirect; prime; variable, semi-variable, fixed; sunk; incremental, etc. etc. Clearly, just to note "cost" is insufficient for certainty of meaning! A particular difficulty surrounds the use of the term 'cost price' in China; following explanation and discussion by Wang et al (2003), the 'cost price' refers to the total cost (direct plus indirect costs) of the item in question, evaluated against a market, or 'official', average. Hence, authoritative guidance is sought - analogous to case precedents for interpretation of common law (as in UK).

Anecdotally, a leading member of a Cost Engineers Association, has stated that, "...the cost here means the tenderer's own and individual cost...". That statement, albeit well intentioned, sheds little light on (the 'official') interpretation(s) of "cost". Zhu and Qian (2001) assert that, "Under the market system, the term 'cost' should be understood as the individual enterprise's cost however, as China is now in a transition period, the time has now come when

the individual cost is used to evaluate the bids, because such cost is not available yet from most of the Chinese construction enterprises. Therefore, the best way is to take the 'cost' as the average cost of the industry for the time being." In countries with extensive and relatively reliable cost data that would be a monumental task of great duration - hardly feasible on a 'per project' basis; given the situation in a country as vast and diverse as mainland China, it would appear to be (practically) impossible!

It would be expected that, following usual competitive practice, even if firms could forecast their costs with complete accuracy, due to differences in structure, organisation and working methods, subcontractors, payment levels, incentive schemes and productivities, each firm's costs would be individual and, to maintain business advantage, confidential. If, however, cost disclosure were mandatory, that would be likely to result in 'business reaction' in such disclosures to attempt to maintain (some) cost secrecy; the accuracy of such disclosed costs is likely to be highly questionable!

Minimum Bid Parameter

To provide a sound, practical and equitable basis for the desired minimum bid parameter (cost or otherwise) an authoritative surrogate measure is appropriate. Although such a parameter would, advisedly, be determined by long term total costs for the 'average' tenderer, together with an addition for 'normal profit', problems could arise due to necessary inclusion of factors for economic conditions, efficiency changes etc. – the myriad of variables in 'cost planning' of construction projects (see, e.g., Seeley, 1996). On the basis that the objective is to afford 'performance assurance' for the client, then the minimum bid parameter might be set as a nominal minimum but with the proviso that if a tenderer bids below that parameter, the rationale must be established by the tenderer to the satisfaction of the client to ensure the viability of that bid and to give

adequate performance assurance (perhaps supported by insurance in the form of a default performance bond - at no additional cost to the client).

Wang et al (2003) discuss the method of applying the cost parameter for minimum bids in Xiamen. That method employs the establishment of average market prices for major items of cost in projects and operates through the following formula (applied to materials as an example):

$$C = \frac{\sum_{1}^{n}(b_i - l_i).m_i}{\sum_{1}^{n}b_i m_i} \times 100\%$$

where:

C = lowest price control (for material)

b_i = average reference price (of a certain material) as announced by government

l_i = lowest wholesale price available in the market

n = number of (materials) expected to be used on the project

m_i = quantity of the consumption (of a certain material)

Aggregation over a project contents and applied to the particular type of project (six types are used) facilitates a 'lowest control line' to be calculated – when a bid is below that control line, the tenderer must justify, with good evidence, that the low bid is reasonable.

Elsewhere in China, minimum cost levels to be applied for evaluation of bids are established by reference to price levels published by government agencies and, then, subjected to adjustment by representatives of the client (sometimes quantity surveyors) to endeavour to reflect the current level of market prices (anecdotally, up to minus 15% of 2001 published prices in Beijing, recently). Clearly, such subjective adjustments are very questionable concerning both their accuracy and

intent, plus their potential consequences!

A further factor of, potentially, great significance on prices is location. In UK, location factors (as index numbers) for building tender prices are produced by the Department of Trade and Industry (of government) and by the Building Cost Information Service. What has been found in such factors is that they are very variable over small geographical distances and, further, that they are unstable both geographically and temporally. More globally, it is acknowledged in publications and by international quantity surveyors and cost engineers that similar variabilities occur both within individual countries and, often to a far greater degree, between countries Given the size and variability of China, producing reasonably reliable locational factors for building prices would be an immensely difficult task. The practical solution would seem to lie in local data collection and production of the factors, requiring constant scrutiny and monitoring to achieve sufficient accuracy and reliability.

The production of minimum tender parametric sums could, given data sources and access, be by authorities (e.g. Department of Standards and Norms; China Engineering Cost Association) who could be active in scrutiny of bids below the parametric level set for any project. Banks and insurance companies would need to develop appropriate standard form performance bonds / insurance policies as recourse mechanisms to further safeguard clients' financial interests on projects.

CONCLUSIONS

If one really desires a free market to operate, then that market should be permitted to dictate costs, prices and profits in constantly striving for (dynamic) equilibrium. It is when control of the 'hidden hands' is desired and implemented that (albeit for laudable reasons) problems, often grounded in human value-judgements, ensue.

'Buying work' through competitive tendering on construction projects, although, potentially, good

business rationally in the short period, is well-known to be fraught with problems, which, ultimately, all to often result in liquidations. In seeking to avoid such problems, mandatory tendering above cost has been incorporated in regulations in mainland China. However, the term cost has not been defined in Article 33 and so, is open to differing interpretations, notably, a tenderer's total cost or lowest (reasonable)bid price as predicted by / on behalf of the client (perhaps a government agency).

A further problem is that the legislation may lead to reduction in business incentives for cost reductions through productivity / efficiency gains as such may cause tendering problems due to potential disqualification of bids which are below expected levels, even if they could be substantiated as viable, the client (representatives), especially on public sector projects may be highly risk averse in this regard through compliance with legislation considerations. Due to the diversity of potential bidders - local, international and joint venture contractors, all with differing arrays of suppliers and subcontractors and, further, with varying spectra of finance sources and costs, the establishing of the viabilities of the possible arrays of bids is extremely difficult. At the domestic level, the consequences of the still emerging financial infrastructure is of relevance to such judgements by impacting on the costs and bids of local firms.

The difficulties are compounded by the realities of cost forecasting and competitive pricing. The numerous vagaries of cost forecasting and the common approach of portraying such stochastic processes in deterministic ways, mean that costs estimated for projects are somewhat unreliable, for individual projects especially – despite the demonstrated application of 'central limit theorem' in aggregate project cost predictions.

In order to secure the stability and performance assurance, stated to be the objectives of the legislators to assist the transition from command to market processes in the construction industry of mainland China (including its facing international

competition), the setting of a 'minimum bid parameter' for each project by a reputable authority is recommended in lieu of the cost statement. Any tender below that parameter would require substantiation and, if accepted, (as could apply to all accepted bids) be supported by a performance bond (or other insurance) at no additional cost to the client. Such an approach would secure competitive incentives towards continuous improvements as well as facilitating stable development by preventing 'artificially' low bids from being submitted and accepted and accruing appropriate levels of project performance (with financial safeguard for the client).

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