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Construction price formation: full-cost pricing or neoclassical microeconomic theory?

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Neo-classical microeconomic theory has been suggested to offer (1) an appropriate analytical tool for construction price determination while, at the same time, (2) full-cost pricing is most commonly accepted pricing policy of construction firms. Paradoxically, however, both are mutually exclusive theories. Only one, if any, can be correct. This paper examines both (1) and (2) by analysis of the evidence available in literature and concludes in favour of (1). It is only in disequilibrium, however, that the differences in behaviour can be clearly observed. In equilibrium, the difference between the two theories from a practical point of view is not very substantial. In addition, the endemic nature of uncertainty in the industry in general makes the task of estimating costs and prices difficult in practice. Therefore, although neoclassical microeconomic theory provides a useful means of *analysis*, it offers little for the *practice* of pricing, which is much more closely related to the marketing discipline than economics.

Keywords: Construction, contracts, pricing, theory, policy, costs, prices, neo-classical microeconomics, marketing

Introduction

Runeson and Skitmore (1999) have shown that the theory implied by Gates (1967), termed tendering theory, fails because it is unable to take into account changes in market conditions, competitors behaviour and the firm's capacity levels. Runeson and Raftery (1997), on the other hand, argue that neo-classical microeconomic theory is likely to succeed. Paradoxically, however, the most predominant form of construction contract pricing according to practitioners is by an absorption, or full-cost, pricing policy. As full–cost pricing, by definition, ignores the demand aspects of the market, it cannot be compatible with classical microeconomic theory. This implies that either (1) neoclassical microeconomic theory holds or (2) a full-cost pricing policy is used, but not both. A clear test of the tenability of (2) relates to the price-setter's approach to demand. If pricing is influenced by changes in demand, (2) is falsified and therefore fails. The conditions under which (1) fails are less easy to define. However, if pricing *is* influenced by changes in demand the main assumption of neo-classical microeconomics is satisfied.

This paper examines both (1) and (2) by analysis of the evidence available in literature and concludes in favour of (1). From a practical point of view, however, it is found that the levels of uncertainty in the industry in general makes the task of estimating costs and prices difficult in practice. Therefore, although neoclassical microeconomic theory provides a useful means of *analysis*, it offers little for the *practice* of pricing.

Pricing services in general

As noted by Rathmell (1966), 'economic products lie along a goods-services continuum, with pure goods at one extreme and pure services at the other, but with most of them falling between these two extremes'. As construction firms provide both materials and labour in equally large amounts, it might be concluded that they then fall about halfway between these

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extremes. However, the nature of construction projects and their complex organizational structures make this picture less than clear. Today, much of the work of building and construction firms is subcontracted. The contractor mainly provides management services. In terms of pricing, the contractor solicits, selects and compiles, with judgement, quotations from subcontractors into a single tender. Projects are undertaken by temporary coalitions of firms with successful completion of the project balanced against profit and long-term interest in survival and growth (Winch, 2001). The firms often form a loosely organized set of subcontractors who work from time to time for a main contractor – a relationships that tends to be essentially long-term and rarely based on price competition. More often than not the subcontractors do not have to bid to win the work, although main contractors often 'test the market' every few years by holding a tender competition between subcontractors (Eccles, 1981).

This suggests construction firms belong to one of the service industries, and service industries are not known for their sophistication in pricing. In the words of one commentator: 'The use of pricing strategies in industrial goods generally lacks even the little sophistication that exists in the consumer goods field, while in services they are virtually non-existent. In part this stems from the *inadequacy of most costing methods* for services, which still operate by the "*faith, hope and 50 percent method*"' (Wilson, 1972, p. 132). That this view is still current is demonstrated in a recent article concerning retail services, where pricing is said to be 'often a perplexing issue for practitioners and researchers alike' (Hoffman *et al.*, 2002).

The pricing strategies of service industries have been classified as either cost-based or market-oriented (Gabor, 1977). Cost-based pricing is equivalent to full cost (absorption) pricing and is primarily concerned with the recovery of production costs and a satisfactory profit. Market-oriented pricing, on the other hand, is aimed at providing a price that maximizes profit, recognizing that the quantity demanded is a function of the price.

Full cost pricing is by far the most popular of the pricing policies found in practice in service industries. As Backman (1953, p. 19) observes 'few ideas have wider currency than the … impression that prices are or should be determined by costs of production'. However, as Gabor (1977, p. 55) comments:

> It is obvious that only a very strong monopoly could be expected to act in this way with impunity; any firm exposed to keen competition is more likely to drop its price when sales are falling off. Yet, it is found repeatedly that when businesspersons are questioned about their pricing policies, the majority will say they use an absorption cost-based pricing method. One might ask how it is possible that they survive in such an irrational way. The answer is that not all of them do, and those who do will be found to act rather differently from their stated principles … If we turn to reports on the results of enquiries conducted by persons with appropriate business experience, we find evidence that pricing is not in fact carried out by the alleged mechanistic application of cost-based formulae.

The result is that full cost pricing is considered to be 'somewhat watered down in practice [where] the manufacturer has a "hunch" as to the price at which the article can be sold, and makes use of "costing" or "estimating" to justify this' (Edwards, 1952) or, equivalently in terms of services, 'frequently applied *to get an idea of the price the competition is likely to quote*' (Gabor, 1977, p. 55). An extreme version of this, of course, is aimed at minimizing the amount of *money left on the table* (Gates, 1960).

Recognizing the need to consider this has prompted the term *backward cost pricing* (Gabor, 1977, p. 42) to describe the policy where the product must fit into a system of conventional prices. This has led to the concept of Product Analysis Pricing (PAP), in which the price is calculated by formula on 'aspects of the product that have significance for [the buyer]', allowing it to become 'a system of delegated pricing', producing 'consistent quotations without the need for constant supervision' (Gabor, 1977, p. 93). Hence, with PAP, *knowledge of production costs is obviated* although there is a need to:

(1) watch how orders are running
(2) follow the competition for wage increases, etc.
(3) have a costing system for new products, value analysis/engineering

In conclusion, therefore, real-world pricing practices in service industries in general essentially differ in the emphasis placed on production costs and prevailing (market) prices – which mirrors most manufacturing organizational structures of separate, and often conflicting, Production and Marketing Departments – with 'the ideal pricing policy being simultaneously profit based, cost conscious, market-oriented and in conformity with any other aims the businessman may have' (Gabor, 1977, p. 43). Clearly though, the amount of available knowledge concerning costs and prices depends on the products involved, with services costs generally being harder to calculate than those incurred in the production of commodities. That this can lead to significantly different pricing strategies as Gabor (1977, p. 216) notes in the case presented by Belgian Professor of Economics, Jean Pierre de Bodt (Bodt, 1956, p. 58), describing how a manufacturer finds the appropriate

price for a new kind of yarn experimentally produced by his firm: he names the highest price he thinks possible to the customer, adding that 'it is *merely an estimate* since costing is still in progress'. If the price is too high, then the manufacturer promises to 'watch the costs' then goes to another customer and repeats the process at a slightly lower price. If, after sales have started, the rate 'exceeds capacity, 'he might increase his price or alternatively … could stimulate sales by a price reduction'. Terming this 'the *experimental approach* to pricing' de Bodt points out that 'this approach to pricing would be considerably more difficult in the case of the typical consumer good [as] its potential customers are numerous, they are further removed from the manufacturer and do not invariably react to price adjustments'.

Pricing construction contracts

By definition, cost-based pricing is concerned predominantly with production costs that, for construction work, are usually taken to be labour, materials, plant and overheads. It follows, therefore, that if the prices for construction work are cost-based, all of the differences in prices between contracts will be directly attributable to differences in actual or estimated production costs. This implies that the major factors affecting cost, such as the physical characteristics, in terms of quality and quantity, of the construction, changes in unit costs of resources (labour, materials and plant), haulage costs, etc., will be the most associated with prices. In fact, this is just the approach prescribed in the standard industry based texts for training students in the practice of estimating and tendering (e.g. Brook, 1998; Bartholomew, 2000; Gould, 2002; Dagostino and Feigenbaum, 2003).

Of the few empirical studies that have been conducted, Eastham's (1986) interviews with ten experienced UK construction contractor personnel produced a lengthy catalogue of the various factors exerting an influence on their tender prices. Of these, the factors regarded as important by more than 70 percent of the interviewees, were the costs of labour, materials, plant, subcontractors, location and transportation, type and size of job, contract period, tender period, competitors, client and professionals – reflecting the dominance of cost in the minds of those involved in the process. Interestingly though, the inclusion of competitors suggests at least some regard for market considerations too. In fact, in a later study of 85 top UK contractors, Shash (1993) found the most important factors in the decision to bid or not to bid to be nearly all market related:

(1) Need for work
(2) Number of competitors tendering
(3) Previous experience on such projects
(4) Project type and size
(5) Owner/promoter/client identity
(6) Contract conditions
(7) Past profit on similar projects
(8) Tendering method
(9) Risk involved owing to nature of work
(10) Availability of qualified staff

Market orientation

The construction industry is well known for its 'high birth and death rate' with a large number of firms constantly entering and leaving the industry (Cassimatis, 1969). The precise reasons for this are not fully understood although ease of entry is facilitated by the relatively low capital requirements of most construction work (Cassimatis, 1969, p. 3). Certain bidding practices, however, such as pre-qualification, form a barrier to entry. Most customers also prefer established firms (Cassimatis, 1969). Barriers to entry are also formed by having to create new supply chains although new suppliers usually plan to poach resources piecemeal from those firms already in the market (Gruneberg and Ive, 2000). Established firms also may have knowledge about customers, sub-contractors or competitors that new entrants may not have (Gruneberg and Ive, 2000). The impact of such barriers is questionable, however, as most firms enter new markets through growth or diversification, being already established in one or more other markets.

Concerning the construction market itself, McCaffer *et al.*'s (1983) estimates of price-levels show that market conditions may be quite different for different types of buildings in different regions, indicating that the industry is divided into several different markets. Hillebrandt (2000, p. 7) defines these in terms of buyers, sellers, building type, size and complexity, location, type of services and type of work. The situation in practice, however, is rather more complicated as many firms operate in more than one market at a time (Hillebrandt, 2000; Runeson, 2000), leaving the ultimate choice to be made at the project level. Therefore, fluctuations in demand for a particular type of work – although greater than in the demand on the industry – may be mitigated by firms operating in more than one market.

Firms leave or enter new markets – a relatively simple activity according to Hillebrandt (2000) and Gruneberg and Ive (2000) or quite complicated according to Teo (1997) and Runeson (2000) – because of changes in

demand or profit levels. Skitmore (1987), for instance, gives examples of builders moving with the seasons from one location to another to obtain work. When construction activity is low, competition for projects becomes intense, and firms start to bid in markets where they do not normally operate (Cassimatis, 1969). When profits are higher in a particular market, firms may buy in expertise in management and enter that market. As a result, such market movements have been said to provide the dominant form of diversification and growth in the industry (Runeson, 2000).

This leaves little room for doubt that contractors focus on markets. Studies have shown this is an increasingly accepted role in the organization, with the marketing function shared among the firm's senior personnel (Bell, 1981). Stocks (1991) has also alluded to a number of studies that reinforce this view, with market segmentation, customer and competitor evaluation, market research, promotion and image building activities being prominent. Smaller firms in many cases employ marketing activities and perceive product diversification as essential to long-term survival (Stocks, 1991, p. 126; Teo, 1997)

Market pricing

As Skitmore (1987) conjectures, 'the structure of the construction industry and the nature of the process lends itself more to market oriented pricing than cost-based pricing' due to the fact that most building contracts are let in competition with prices declared; the construction service is rarely unique; and freedom in pricing is limited by the actions of competitors.

That construction prices are market-oriented is also borne out in the literature, firstly by Fine (1974), who proposed the term 'socially acceptable' prices to represent the market price, and then many times since in statements by industrialists, e.g. 'Prices vary according to market conditions' (Shealy, 1986, p. 18); 'The cost of the project must be established … in the marketplace … market factors can have significant consequences' (Mueller, 1986, p. E6.7); and consultants, e.g. 'must be responsive to the market place' (McDonagh, 1986, p. 3716), 'the need to make accurate adjustments for market conditions' (Morrison, 1984, p. 74); as well as academic writers, e.g.,'Tender price[s] … show deviations from the national pattern in response to local changes in market conditions (Avery, 1982, p. 162); and 'Most contractors have a view of the likely market price' (Hillebrandt, 2000, p. 167). Skitmore's (1987, p. 13) interview survey of the perceived effects of the market on construction prices also found opinions that prices are market driven, determined by market forces alone, together with the comment that '"builders know the going rate", the "social price", or what has been termed "a preconceived proper price"'. In short, construction contractors are 'price-takers' (Hillebrandt, 2000; Runeson, 2000) with prices determined by demand and supply.

Effects of changes in demand

The effect of market changes on construction prices is that prices rise as demand increases and fall when demand declines (Stone, 1983). Because many firms are diversified so that the transfer of resources from one market to another becomes an internal arrangement, and other resources are employable across several market segments, price changes in individual markets often spread into other markets. The effects of changes in demand were dramatically illustrated in the UK during the 1970s, when similar movements in the tender price index at the time accompanied movements in the order index. Another demonstration of this is in de Neufville *et al.*'s (1977) analysis of 691 Massachusetts highway projects, which shows a systematic difference between average low bid/engineers' estimate ratios between 'good' and 'bad' years (good and bad being defined as years with the greatest and least activity for contractors).

Despite the transferability of resources from one market to another, geographical differences in demand have been found to be associated with geographical differences in prices (Beeston, 1983) – Avery (1987, p. 158) finding 'strong local influences on tender levels' in factories in two Scottish regions. Skitmore (1987, p. 32) also found a high demand in the north east of the USA to be associated with high building prices. He also noted that shifts in demand in Florida from the Cape to Orlando and back to the Cape produced similar shifts in price levels.

Demand related seasonal fluctuations in building prices have also been observed by Beeston (1983) with a slight tendency for prices to reflect the uneven availability of funds during the financial year. A similar observation has been recorded in Canada, where the increased autumn demand is said to correspond with increased price levels (Skitmore, 1987). There have even been suggestions for the strategic placement of contracts on the market to avoid the autumn price peak (Johnson, 1978; Skitmore, 1987, p. 35).

Effects of changes in supply

In considering the supply-side, 'there is a widely held belief that increases in supply levels (availability of contractors) cause decreases in price levels' (Skitmore, 1987). Decreases in local capacity are thought to

increase prices generally (Bronel, 1986) or in specialist work such as electrical installations (Skitmore, 1987). Increases in local capacity because of a seasonal influx of more local contractors have been thought to lower prices in the Florida winter period (Skitmore, 1987).

The level of supply for construction work is usually referred to in terms of the degree, or intensity of competition, the greater the intensity, the less the price. Construction is said to be a highly competitive industry and, although some specialists may occupy dominant positions and contractors may occasionally avoid bidding altogether in high intensity situations (Skitmore, 1987), many organizations feel they have to fight for survival. This also applies to sub-contractors who have to be equally competitive and may be bartered down by general contractors (May *et al.*, 2001). Clients have been known to apply similar pressure on general contractors in bartering or breaking trades to further increase competition (Skitmore, 1987; Williamson *et al.*, 2004). The general result is what has been termed the 'ebb and flow in the market place' where clients are trying to maximize competitive intensity and contractors are trying to reduce it, or at least pass on the effect (Skitmore, 1987, p. 43).

Many bidders, it seems, base their prices on the anticipated intensity of competition. If the resulting figure is adjudged to be too low, the bidder will withdraw (Skitmore, 1987). Alternatively, the price may be stated by the client with the same result (Skitmore, 1987). One measure of the intensity of competition is the number of contractors bidding in open competition. By this measure, we would expect that greater numbers of bidders would result in lower prices. Skitmore's (2002) analysis of ten previously published data sets gathered throughout the world shows this to be true, indicating a decrease in the order of 20% to 25% from 2 to 15 bidders.

One interpretation of the number of bidders is that it reflects 'hunger for work' (Skitmore, 1987). Hunger for work can be interpreted two ways. Firstly, it may be seen as a reflection of a change in demand. This would mean, in de Neufville *et al.*'s terms, the difference between good years with a large volume of work, and bad years, when contractors are hungry for work. De Neufville et al's analysis indicates clearly that the good/bad year effect is separate from the number of bidders' effect. The second interpretation of hunger for work is that it is a reflection of the availability of resources and therefore what we have termed 'intensity of competition' for which our number of bidders' variable is a proxy. It should be noted, though, that the number of bidders is only an indication of intensity of competition. As one of Skitmore's (1997) interviewees recalled, intense competition can take place even with only two contractors involved.

Combined effects of changes in demand and supply

In an open market, the general availability of projects affects the intensity of competition as measured by the number of bids entered for each project. Hanscomb's analysis of Corps of Engineers projects found the average number of bids entered for each project each year' correlates well with overall economic activity – supporting the view that 'the higher the level of economic activity, the more construction there is and the fewer bids one is likely to receive and vice versa' (Hanscomb, 1984).

Hanscomb unfortunately omits to provide details of the 'economic activity' during these years. De Neufville *et al.* (1977), however, used the number of projects per year as an indicator of demand in their analysis of the Commonwealth of Massachusetts Bureau of Building Construction projects. This analysis clearly shows the inverse relationship between demand (projects) and intensity of competition.

Other data from the Department of Public Works were also claimed to present a similar pattern (Neufville *et al.*, 1977). This general inflexibility in supply to respond to increases in demand leads to increased construction times and longer waiting times (Skitmore, 1987). There is also a view that the quality of work deteriorates as demand increases (Skitmore, 1987, p. 60).

In the USA, there is some evidence, however, that interstate migration is a mitigating factor due to the local seasonal trends mentioned earlier and also interstate demand differences. The latter phenomenon is evidenced by the proliferation of Texan contractors outside Texas in the 1980s due to falling demand in Texas, and more generally, in the practice of northern state contractors, e.g. in Cleveland and Detroit, to seek work in Texas when weather conditions restrict local work (Skitmore, 1987, p. 60).

If demand increases without a corresponding rise in supply, we would expect prices to increase accordingly. If, however, supply increases quickly enough to meet increases in demand then there may be very little effect on price levels. In North America at least, this depends on the extent of interstate migration of contractors. An example from one of Skitmore's (1987, p. 61) interviewees illustrates the point:

> One of the first things I was asked to do when I got to EXPO '67 in Montreal in 1963 was to assess the effect which the demand for half a billion dollars worth of construction (three times that in today's [1987] prices) was going to have. Not surprisingly, I concluded that we were going to have some problems, but in fact with two or three minor exceptions, there were no critical problems – labour was drawn to Montreal from hundreds of miles away and material shortages were rapidly made good by imports.

At the time of Skitmore's study, there was a growing impression in the USA that increases in demand were being accompanied by some restraining force. A report on construction activity in a Cost Engineering Journal at the time included the comment that 'First quarter sales of a broad sample of building products manufacturers advanced over five percent over the year ago period, but with costs rising while prices remain steady, profits were squeezed four percent below the 1985's first quarter' (*Cost Engineering*, 1986, p. 27).

A similar situation also seemed to exist in the UK. In the period from 1979 to the mid 80s for example, although the total number of people employed was virtually constant, the number of companies in the industry increased dramatically since 1979 due mainly to government action in promoting the establishment of small firms. The combined effects of falling demand and changing organization of supply between 1979 and 1982 resulted in a depression of price levels during that time. Although demand appeared to have increased since that time, the competitive pressures involved nevertheless continued to hold prices down.

The effect of market characteristics

In addition to the *level* of demand and supply, construction prices are affected by the characteristics of the market. In Chan *et al.*'s (1996) analysis of a lengthy time series of a single Australian contractor's records, more than two-thirds of the variations in profit/loss could be explained in terms of market characteristics and conditions. Similarly, Runeson (1988) found that market conditions accounted for twenty percent of the variability of the distribution of unit and trade rates in the bills of quantities of successful bidders. Overall, Skitmore (1987) identifies the most important of the market characteristics in affecting prices to be building type, procurement type and geographical location.

While these characteristics can often be attributed to both costs *and* markets, some studies have been able to unequivocally isolate the market influence. The classical case is Fine's (1974, p. 117) study on the effects of different building types on price:

> Sets of drawings and documents were sent to a number of contractors for pricing. Some contractors received documents and drawings for the shell and main services for a repertory theatre; others received drawings and documents for a barn. The only difference between the sets of drawings and documents sent out was in name only, that of the label of barn or theatre attached. Estimates for the theatres averaged £300 000 those for the barn £30 000.

Such other factors that have been found seem to be more concerned with the way uncertainties are handled rather than the influence of the market. These are introduced in the next section.

Uncertainty

The construction industry is characterized by a high degree of uncertainty (e.g. Tavistock Institute of Human Relations, 1966; Raftery 1991, p. 188). Several reasons for this have been suggested:

(1) There is a great deal of variability in productivity levels both between projects and between activities on the same project and hence a great deal of variability of actual production costs.
(2) Much of the information needed in terms of production costs and market prices is not available in a suitable form,or just not available, and the heterogeneous nature of the finished product largely prohibits the comparison of prices that is the norm in other industries (Cassimatis, 1969, p. 155).
(3) There is a lack of consistency and detail in firms' accounting and reporting.
(4) As far as pricing is concerned, forecasts are needed of future events and such forecasts are inherently unreliable (e.g. Bon, 1989).

Of the many significant implications of this, one is that quantity demanded is outside the contractors' and subcontractors' control, as it always is for production. In addition, few contractors know what their real costs will be as the cost curve of the firm is not constant but varies with resource utilization and general economic conditions over a wide range (Runeson, 2000).

Costs and prices of construction work

Standard economic theory assumes that at least costs can be 'reckoned correctly' (Stigler 1987, p. 53), while the main practical difficulties faced in pricing construction work are concerned with the imprecision of the estimates of production costs *and* market prices. In practice, a wide variety of approaches are used in attempting to make these estimates as accurate as possible in the circumstances. These include efforts to collect information on the state of the market – price levels, likely future contracts, activities of competitors, etc. (e.g. Skitmore, 1989). Many quantitative approaches have also been developed as an aid to estimating costs and price levels (e.g. Skitmore, 1989). The most sophisticated of these are those that treat either estimated costs or actual costs as variable, the difference being that some authors consider estimated

costs to be a stochastic variable and the true cost as non-stochastic, while others take the true cost as being stochastic and estimated cost as non-stochastic – in statistical terms, this is basically a classical vs. Bayesian point of view (Naert and Weverbergh, 1978, p. 362).

The main practical difficulties faced in pricing construction work are concerned with the imprecision of the estimates of production costs *and* market prices. A wide variety of approaches may be used in attempting to make these estimates as accurate as possible in the circumstances and include efforts to collect information on the state of the market – price levels, likely future contracts, activities of competitors, etc. (e.g. Skitmore, 1989).

Estimated and actual costs

Table 1 summarizes the situation regarding the assumptions concerning production costs made by the various theories. For the standard private value auctions, full-cost theory and naïve tendering theory (e.g. Gates, 1960; Park, 1966), actual costs are assumed to be known with certainty. For situations where a true cost is assumed to exist, but its estimation is subject to some error, Hillebrandt (2000, p. 114) has suggested using a 'band of costs' to represent the cost curve of the firm. Common value auctions also assume that a true cost exists but it can only be estimated, as also the case with the more advanced 'classical' treatments in tendering theory (e.g. Friedman, 1956; Capen *et al.*, 1971; Weverbergh, 1978; Skitmore and Pemberton, 1994). Management theories, on the other hand, tend to assume that the forecast, or budget cost is fixed and that production activities are sufficiently variable to be somehow manipulated to be kept within budget. In construction, this fixing of budget costs is often done by reference to the estimator's 'little black book' of figures that the estimator knows from experience will provide a reasonable target for site managers. Bayesian tendering theory (e.g. Park, 1966; Vergara, 1977) adopts the same principle.

Another version of tendering theory treats both the costs and the estimates as random variables (Fuerst, 1977; Rothkopf, 1980) – an approach said to be justified as variability in estimates of production and costs exists both before and after the event as estimates are guesses of future costs and accounts are guesses at past costs (Fine and Hackemar, 1970). In their view, the two variables may not be strongly causally dependent, certainly as far as feedback is concerned, for in theory the estimator's guess should be based on accounting data and should be obtained from these by a process of manipulation and calculation – something that is seldom done in practice (Fine and Hackemar, 1970, p. 1). In one study of six builders' estimators for example (Hampson, 1979), it was found that only one estimator kept formal records of site performance.

The practical implications of viewing this fourth quadrant, however, are rather hazy and lead to some confusion. Park and Chapin (1992, p. 194), for example, suggest that 'A good detailed estimate should generally be accurate within 5%. Even so, on the average, actual costs may vary by as much as 20% from the estimated costs' – a seemingly nonsense statement that Runeson (2000) interprets as meaning a 5% accuracy in estimating *price* with a 20% accuracy in estimating *cost*.

Costs and prices

Now, although there is extensive literature on estimating construction *prices*, both at the macro and micro (project) level (Skitmore and Marston, 1999), all are aimed at the consultants of the industry rather than the contractors – presumably as contractors are assumed to be pricing in accordance with full-cost theory. The counter-view is not new, however, and certainly exists in the industry's folklore. Both Ferry and Brandon (1984, p. 157) and Drew (1994), for example, have suggested that contractors can occasionally write down the cost of the job before they start pricing it.

The obvious conclusion to be drawn is that there must be a duality: contractors' estimate both production costs *and* a market price for each contract. In this, there is also nothing new and the notion of estimating costs and adding a market-oriented mark-up is standard both in principle and practice in construction. Where the

Table 1 Assumptions concerning costs

		Actual cost	
		Fixed (error free)	Variable (error)
Estimated cost	Fixed (error free)	• Private value auctions • Full-cost theory (cost-based pricing) • Tendering theory (naïve)	• Management theory • 'Black book' • Tendering theory (Bayesian)
	Variable (error)	• 'Band of cost' • Common value auctions • Tendering theory (classical)	?

modern literature deviates from this is in how such estimates are made in conditions of uncertainty. Gruneberg and Ive (2000, p. 244), for example, 'assume that each firm first calculates its minimum acceptable price (MAP) for a project [this being] the lowest price at which it would be very surprised to make a significant out-turn loss', which is clearly what would be expected of a cost estimate under conditions of uncertainty.

For estimating *price*, Gruneberg and Ive (2000, p. 238) allude to 'the fact that project tenders are sequenced through time … is of considerable importance [otherwise] there could be no iterative process of groping towards the most profitable attainable set of prices, using feedback information from the success or failure of previous tender' concluding, tantalisingly, that 'mention of iteration and feedback is taking us too soon towards the *real* world'!

Are genuine estimates of costs needed?

As Runeson (2000, p. 158) points out, like PAP, this latter approach to pricing logically removes even the minimal requirement for MAP estimates for 'it is not necessary for the bidder to make a point estimate of the actual cost. All that is necessary is that the bidder accepts the market price as giving an acceptable probability of profit without an unacceptable risk of a loss', leading him to the conclusion that cost estimates 'are estimates, not of cost, but of the market price' (2000, p. 160).

In fact, much of what is known from studies of industry practice is in conformity with this. Whittaker (1970) for instance found several instances of estimators deliberately reducing their cost estimates because they felt that mark ups decided by management were too high. Whittaker also recounts an interview with a manager who, as a result of analysing past bids, 'decided to increase his mark up wondering how long it would be before his estimators realized his action and started to decrease their cost estimates'!

Figure 1 summarizes the situation overall. This shows the two dimensions of cost and price ranging from completely certain to completely uncertain, with probabilistic assessment being somewhere in-between. The black circles represent theory assumptions. For example, standard economic theory exists where both costs and prices are given (certain), while full-cost theory exists where costs are given (certain) but prices are discretionary (uncertain). Auction theory (AT) and bidding theory, on the other hand, exists where price is

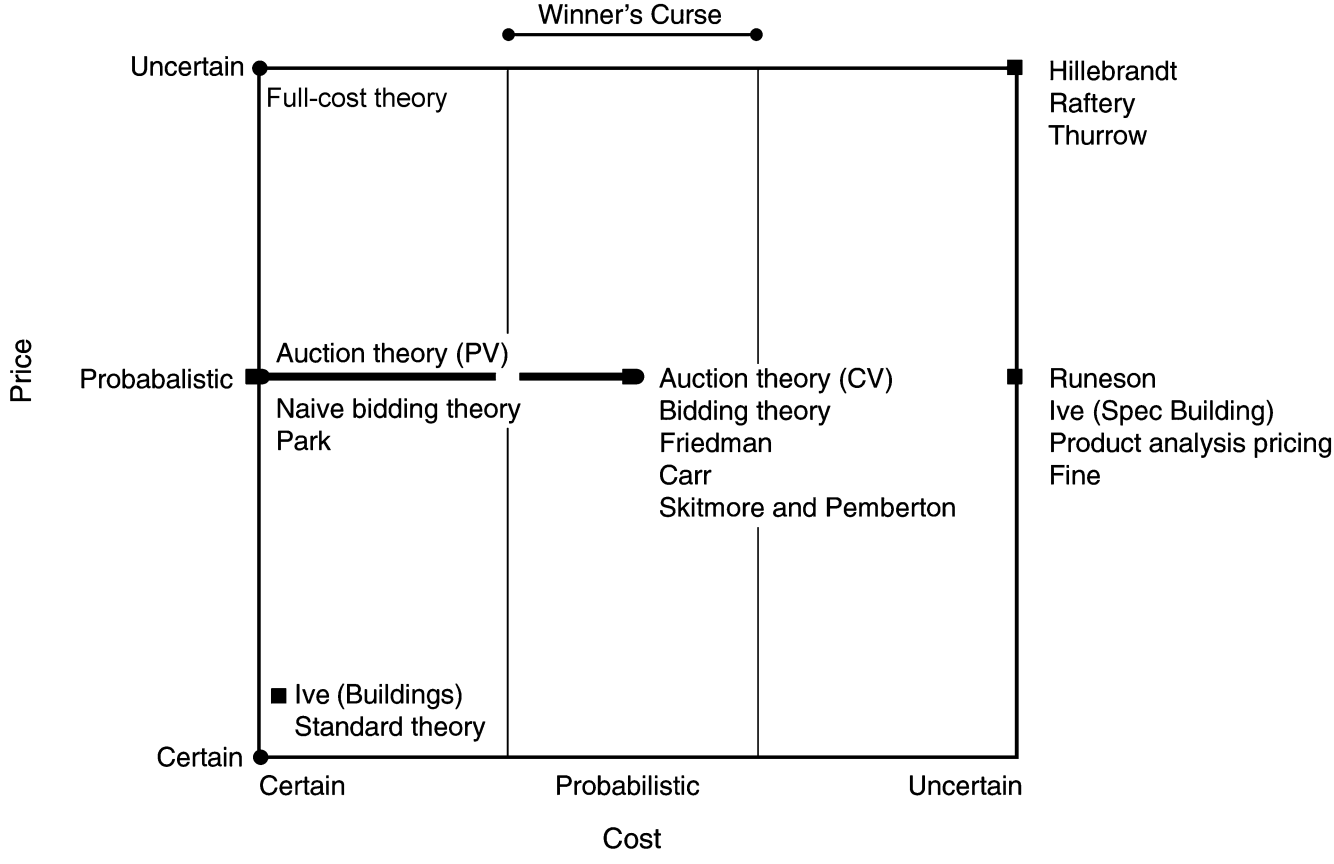

Figure 1 Costs and prices

probabilistic and costs range between certain (private value auction theory and Park's naive bidding theory) and probabilistic (common value auction theory and the rather less naïve bidding theories of Friedman, Carr, etc). Probabilistic costs are needed for winner's curse to apply. The black squares represent what has been said to exist in reality. With the exception of Gruneberg and Ive's building projects, which seem to be virtually certain in terms of both costs and price, all are uncertain in terms of cost – with price being either probabilistic (e.g. Fine, Gruneberg and Ive's speculative buildings), uncertain (e.g. Hillebrandt and Raftery) or given (Runeson).

Conclusions

In this paper, we have examined the tenability of two mutually exclusive accounts of construction contract pricing: either (1) classical microeconomic theory or (2) full-cost pricing theory holds. In examining these theories from the perspective of the construction contract industry, it is clear that firms are certainly market-aware and concerned with *both* production costs and market prices, making pure full-cost pricing highly unlikely.

The situation is different, however, for neoclassical microeconomic theory. The market price is determined by demand and supply. The estimate of the cost for each project is a closer approximation to the marginal cost than there is in any consumer goods market. The tender price, on the other hand is the marginal revenue. In the construction industry, however, both demand and supply are 'lumpy'. They come in the form of big projects which means that the marginal cost is not a smooth curve but progressing stepwise, while the time to complete projects means that it takes time for price changes to work their way through the market. At any time, there will be projects for which the price was set months or years ago in possibly a different market.

It is only in disequilibrium, however, that the differences in behaviour can be clearly observed. In equilibrium, the difference between the two theories from a practical point of view is not very substantial. Also, the high levels of uncertainty in the industry in general makes the task of estimating costs and prices notoriously difficult in practice. Therefore, although neoclassical microeconomic theory provides a useful means of *analysis*, ironically it offers little guidance for day-to-day decision-making *practice*. This is hardly a new discovery for, as Oxenfeldt (1975, p. 10) asserts, '[while] pricing has been written about in great depth by economists for centuries, many price setter who have looked for help in a study of price theory and the literature on pricing have not found the effort too rewarding'. In distinguishing between *economic theory* – that 'seeks to explain basic economic forces' and *the practice of setting and changing of price* – representing 'a species of human behaviour that reflects perceptions, cogitations, aspirations and preconceptions' – it is clear that the latter is more appropriately treated as 'one of the many interrelated marketing instruments that pose most of the usual problems of management'.

It comes as no surprise, therefore, to find this duality maintained in most construction industry courses today, with both 'Economics' and 'Estimating/Pricing' being studied as entirely independent disciplines as both offer completely different perspectives on the issue of pricing. However, while the role of economic theory in construction pricing has been well explored to date, the same cannot be said of the marketing perspective. The fundamental understanding of construction pricing practice, it is suggested, would benefit considerably from closer examination within this paradigm.

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