VOORBURG GROUP ON SERVICE STATISTICS

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PRICING SERVICES OF CONSULTING ENGINEERS

Statistics Canada

THE PRICING OF SERVICES OF CONSULTING ENGINEERS

INTRODUCTION

For the last few years, Canada has been developing and improving statistics in the Business Services area. Until recently this activity had not included the development of price indexes although a proposed methodology for pricing some of these services was presented at the 1989 meeting of the Voorburg group. In the summer of 1990 an attempt to start measuring price change for the outputs of Consulting Engineers was begun, following the method described in the 1989 paper. That method is described as "model pricing" as it depends on participants in the survey providing price estimates on a hypothetical contract which serves as a model for the type of work they do. It is used in those situations where actual contracts are unique, so that repeated prices cannot be given for them. This paper describes how model pricing is being applied to the Consulting Engineering Industry, and what information has been collected so far.

SCOPE AND COVERAGE

The target of the survey was part of the set of companies classified to ISIC 7421 (Offices of Consulting Engineers: SIC 7752 in the Canadian Standard Industrial Classification). In practice the coverage was restricted; the value of output of smaller companies is derived from tax data, and does not provide much detail describing the type of activity that these companies are engaged in. Furthermore, in light of the stress that the methodology to be followed would put on respondents' resources, it was thought preferable not to survey smaller companies. This left about 500 respondents to the 1989 Survey of Consulting Engineers, (referred to in the rest of this paper as the Output Survey), some of whom were branches of the same organization. Of the 500 about 50 accounted for 50% of total income. It was intended to survey most of these largest, and a sample of the rest.

Fee income only was selected for pricing. Many respondents earned a substantial portion of their total revenue from other operating revenue, or from non-operating revenue:- 36.4% of total revenue in 1989. Most of this was Reimbursables (29.0%) and Sub-consultant fees (5.9%). Reimbursables are varied expenses which the client pays, but are not part of the contract. Sub-consultant fees, when they are for engineering work, will be covered under another respondent's fee income, and where not engineering, are too varied to cover.

SELECTION OF RESPONDENTS

The survey of prices was preceded by about three years by a concentrated attempt to capture the values and nature of output. Engineering companies were familiar with statistical requirements, and survey takers were acquainted with the willingness of some companies to respond. As the price survey methodology would require the extensive cooperation of respondents it was decided not to approach some companies. As a matter of practice, the coverage requirements for price surveys are not as stringent as for output surveys, as price surveys are almost always samples that reflect the survey taker's judgement.

The Output Survey provided a breakdown of fee income in three ways, any of which might be subject to different price movements: by field of specialization, by whether the income was earned from a domestic or a foreign contract, and by type of service provided. In selecting respondents, after choosing the largest, the first intention was to represent the range of specialization: that is whether the respondent mainly worked in buildings, civil works, industrial works and so on. (See table 1). No particular effort was made to select respondents according to the services (as developed in the CPC) they provided; it was expected that while some companies would specialise in certain types of service, many would provide a range of services and an appropriate representation of these would be obtained in the course of selecting representative models from each of the chosen respondents. Some attempt was made to capture data on foreign contracts, but not at the expense of getting good data on domestic projects.

RESPONSE RATE

Almost all businesses approached agreed to participate in the price survey. This is thought to be largely attributable to two main factors: engineers had been involved in the development of the survey of outputs, and the Professional Association was in support of the survey. All potential respondents were visited, often twice, to explain the survey, answer questions, and explore what data should be supplied. These interviews typically took several hours.

SELECTION OF PROJECTS TO BE PRICED

The model pricing technique can follow either of two forms: all respondents may be asked to provide estimates on the same model, or each may report on one that the respondent is familiar with. When a common model is used, as in the estimation of price indexes for non-residential construction, there is the advantage that estimates from different respondents can be compared in the editing process. This requires that the same knowledge about the model be available to all respondents. In construction this can take the form of

blueprints. In the case of engineering work, with its aspects of consultation and management, the variation in each contract prevents writing a specification that could be used to get similar estimates on a reliable basis from all respondents. Consequently in this survey, each respondent was asked to select one or more representative contracts which had been undertaken fairly recently. Details of this(these) project(s) provided the benchmark data, and become the model(s) for subsequent re-estimating.

In extensive interviews each respondent was asked to describe what kind of activity they engaged in and what factors caused prices to be different. These factors included the type of client- and thus the field of specialization-, market conditions, the size of the contract, the complexity of the work, and how frequently business was done with the same client. A number of representative contracts were chosen to reflect the diversity of the work in which respondents were engaged. At this time the survey includes details on 54 contracts.

HOW CONTRACT PRICES ARE SET

There are three typical types of pricing methods in the industry: fixed price contract; cost-plus contract; and percentage of the construction cost contract. The information available for pricing purposes for the first two types of contract is very similar; in both cases a considerable amount of detailed information is available including the cost and amount of human resources involved in the project (person-hours and labour cost) and on the "multipliers" used to adjust direct costs to take into account overheads and other associated costs, and to reflect current market conditions.

Some respondents reported that they obtained work on the basis of a percentage of construction costs. Pricing in this case, requires that estimates of the changes in construction costs, and how the percentage charged varies through time, be available. The price index for engineering work can be calculated by multiplying the index of the percentage charged by the price index of the construction work to which it applies. The projects priced this way, it was reported, are generally smaller ones, and typically related to buildings rather than other kinds of engineering. Reportedly, this pricing technique is more common with architects.

TYPES OF SERVICE INVOLVED IN MODELS

Most engineering contracts involve a number of activities. It was important to discover whether these different activities in a project can be identified and classified to the C.P.C. From the detailed accounts supplied by respondents it was usually easy to map the various items onto the classification of types of service according to the CPC:

86721	Advisory and Consultative engineering services
	Engineering Design services:
86722	- for foundations and building structures
86723	- for mechanical and electrical work in buildings
86724	- for civil engineering works
86725	- for industrial process and production
86726	- not elsewhere classified
86727	Engineering services during the construction and installation phase
86729	Other engineering services
8673	Integrated engineering services
xxxx	Project Management services (no assigned code at present)

The kinds of contracts selected vary in complexity, but typically fell into one of three groups. The simplest contracts (7% of the total) only included Advisory or Consultative services. Some were largely advisory, but included a small amount of another service. The average value of engineering services in these projects was $4m.

About 45% of contracts combined one or two specialised Design Services with Project Management services, and sometimes Construction Management services as well. The distinction between these last two services is well understood in the industry. The average value of engineering services in these contracts was $5.5m.

The remaining 45% of contracts were large undertakings in which most if not all services were provided, including several design specialities. In almost all cases Project Management and Construction Management were a large proportion of the contract. Although companies in other industries can also supply these

services, engineering companies are often chosen to do this, presumably because of their intimate knowledge of the physical aspects of the project. The average value of engineering services in these projects was $28.3m; the median value was $25.8m.

The average size of these models is large. There are many engineering companies that specialise in one type of service only. However, with the concentration on large companies, the others have not yet been surveyed.

REPRESENTATION OF MODELS BY FIELD OF SPECIALIZATION

Although different services command different prices, which may move differently over time, these services are bundled together in many models. It is possible that the price movements of services of engineers may differ according to the type of work they are engaged in, quite apart from the mix of services being provided. Accordingly, how the distribution of the selected models compares with the distribution of engineers' activity is of interest. Table 1 shows the percentage distribution of the values of selected models by field of specialization compared to the distribution of all fee revenue from the 1989 Output Survey of engineers. In the Output survey, thirteen different fields of specialisation are identified, which have been combined into the groups shown here.

TABLE 1: PERCENTAGE DISTRIBUTION OF FEE INCOME BY FIELD OF SPECIALIZATION

	Buildings	Civil Engineering	Industrial Process	Other
Fee revenue				
All firms (1989)	18.5	34.5	35.0	12.0
From selected models	3.4	38.6	58.0	.0

At this time, building projects, (both Structural and Mechanical and Electrical) are underrepresented partly because projects charged on a percentage of cost basis have not yet been collected, and partly because of the concentration on large contracts. Whether or not the representation of fields of specialisation in the selection of models is significant depends upon future findings with respect to the movement of prices.

REPRESENTATION OF MODELS BY TYPE OF SERVICE

In order to set representation of the range of services provided an indirect two-stage process was adopted. The pricing models were chosen to represent the kind of work in which each respondent is engaged; the representation of services provided depended on the details of the contracts supplied by each respondent.

Table 2 below shows the distribution of values by type of service in the selected models, compared to the percentage distribution of fee income from the 1988 Output Survey. It also shows the number of models out of the 54 collected that include each of the different services. Many models include the provision of more than one design speciality.

TABLE 2: PERCENTAGE DISTRIBUTION OF FEE INCOME BY TYPE OF SERVICE

	Advisory +Consultative	Design Services	Other Eng.Servs	Project Management	Integrated[1] Eng. Servs.
	86721	86722-6	86727,9		8673
Fee revenue					
All firms (1989)	16.0	47.5	13.0	16.0	7.5
From models	9.8	57.7	19.7	12.8	
Number of models with each service	39	48	43	43	

"Other engineering services" in this table includes engineering services during the construction and installation stage.

Again, the test of these distributions will come over time as price movements for the different services can be compared.

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[1] Turnkey projects are large projects wherein the contracting company not only designs the project, but also builds it. Construction costs are the most important element of the project, though only the value of engineering services is included in the Output survey. In most cases, such projects relate to industrial plant processes; they are less likely, in Canada, in transportation or water supply/waste treatment projects, as there is no proprietary process involved in these cases. In the selection of projects turnkey projects were not considered.

RELATIONSHIP BETWEEN FIELD OF SPECIALISATION AND TYPE OF SERVICE

It is likely that the distribution of services provided varies with the type of contract, certainly with the size of the contract, and possibly with the field of specialisation. The Output survey does not collect revenue by field of specialisation cross-classified by service provided, but the types of service included in selected models can be so classified. Table 3 shows the distribution of types of service provided by the field of specialisation to which each model belongs.

TABLE 3: PERCENTAGE DISTRIBUTION OF TYPE OF SERVICE IN SELECTED MODELS BY FIELD OF SPECIALISATION

	Type of service				
	Advisory +Consultative	Design Services	Construction Management	Other Eng. Serv.	Project Management
	86721	86722-6	86727	86729	
Field of specialisation					
Buildings	4.9	62.7	21.0	1.1	10.3
Civil Engineering	18.7	59.2	7.2	4.5	10.4
Industrial Process	4.2	56.4	17.4	7.5	14.5

BEHAVIOUR OF PRICES OVER TIME

At this point no systematic information on the movement of project prices over time has been collected. However, from the historical data that have been collected, and from what has been learned from the first round of surveying some speculations can be made.

Given the common method of estimating and costing time required, and applying a multiplier to it, variation of price movements for different services within a project depends on three factors: variation of time required for various services, variation in the costs of that time, and variation in the multipliers.

If the same work can be done in less time required there is a productivity improvement. The main long-term advantage of model pricing rather than input pricing is that productivity improvements can be reflected in the pricing. Some potential change is explicitly excluded. It is likely that if a particular contract was to be repeated it could be done more efficiently the second time. However, the conditions under which the model is repriced exclude

this; the project is to be repriced as if the company were trying to win that contract- for the first time- in the market conditions at the time of repricing. This is clearly a hypothetical condition, and care has to be taken that the respondent understands it. On the other hand, if a company's way of doing business has changed since the last pricing, that is permitted. It is not required that the business assemble its cost estimate in exactly the same way as it costed the contract historically. If new capital that permits work to be done more effectively has been installed the repricing should reflect it.

Variation from one period to another in the costs of the time charged may occur because of different salary movements for different groups or because a different mix of staff is used. Salary rates are expected to diverge only modestly. In principle, by specifying an unchanged output, model pricing, holds quality of service constant. However, if a different mix of staff is used, or less experienced staff is used and the respondent's opinion is that the contract can be won with that costing, that is acceptable, as it may not be possible to establish what effect this has had on the quality of the service provided. We do not yet know how often changes of this kind will occur.

Differences in the multiplier at a given point of time seem to be rare within one model. Certainly the same multiplier is used for all aspects of design services. Consequently, changes in the price movement of different engineering services in total, derived from the effect of the multiplier, depends on how they are represented in different models.

Differences in the multiplier for different models to be bid on by the same respondent at the same time seem to depend on the size of the respondent. Smaller companies, specialising in one or two areas, will tend to bid on any contract in much the same way. Larger companies, however, may vary their bid depending on what the field of specialization is.

Changes over time in the size of the multiplier for a given project can be large. From the little data that are available covering more than one period for a single project, it appears that while the labour costs may rise, the multiplier has fallen so much that the total estimated cost for the model may be lower now than its historical cost one or two years ago. This is presumably a reflection of sensitivity to the market, and this sensitivity, similar to what has been seen in the output construction price indexes, is what mainly distinguishes this approach from input price indexes in the short run.

SUMMARY AND FURTHER QUESTIONS

Experience in this survey so far has shown that it is possible to apply the proposed model pricing technique to Consulting Engineers. It also appears that the services provided can be classified from companies project data to the C.P.C. categories at the finest level defined, although it is not yet clear whether different price movements are associated with different services at that level of detail. It appears that the selection of respondents, while giving a reasonable representation of types of service, does not yet properly represent smaller companies, or building work which may be bid in a different manner.

Apart from remedying these gaps in the sample, the next stage is to collect systematically estimates of repricing for the current period. It is intended that models be repriced annually. There are a number of questions which the behaviour of the price data over time have yet to answer. It has yet to be seen whether prices move differently for different services, or for the same services within different fields of specialisation. It may turn out that price movement, rather than being specific to the service provided, or to the field of specialisation, is company specific. As many larger companies can apply their resources to any area, how their bidding differs from one year to the next may depend more on the market position of the company than on the particular project being bid on, or on the particular bundle of services being provided. Whether this occurs also affects whether building components, which are part of larger engineering projects should be separately identified in the index number making. The answers to these questions may be found from the data to be collected in the next few years.