Quantity and Price Measures for Business Services:

The case of Engineering and Architectural Services

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The following is an outline, for discussion purposes, of a proposal to adopt the model pricing approach to the measurement of engineering and architectural services.

The lack of progress, hitherto, in developing a consistent system of value, quantity and price measures for the service-producing industries may be ascribed mainly to the following three factors. Firstly, there existed a widely shared belief that services are esoteric, and constantly changing, and that each service is intrinsically unique. Secondly, until the development of the C.P.C. and the efforts of the Voorburg Group, there was no consistent classification framework for services, comparable to that for goods. Thirdly, there was a general lack of adequate field work and associated research for developing a proper understanding of the role and the operations of each industry and the nature of its products. On all three counts, there appears to be considerable progress at present.

In Canada, as no doubt elsewhere, services to business had suffered most severely from past neglect and the myth of non-measurability. This myth now appears to have been largely dispelled and work is underway to improve measurement.

Services to business constitute the most complex and the most rapidly expanding area within the service sector. They also have a sizeable foreign trade component. Not surprisingly, therefore, business services have, of late, been of considerable interest to policy analysts in government and industry. It is for all these reasons that over the past few years Canadian statistical development in the service industries has largely focussed on business services.

In the past, much of the development effort had been devoted to putting in place indicators of price and quantity for the so-called traditional services, such as transportation and consumer services. In the case of transportation, a plethora of volume indicators has been developed over the years, although some conceptual issues remain unresolved. Efforts to develop quantity indicators for other services have been less successful. In the case of retail trade and personal services, a range of price indexes are available as part of the Consumer Price Index system. Further imaginative price index development work, such as model pricing, has been carried out in Canada in the context of pricing capital or investment projects.

Many of the consumer and capital price index components, and most certainly some of the techniques used to compute them, can be used to advantage in developing and expanding the library of deflators for the service industries. The presumption is that the development of price indexes as deflators will, as a general rule, yield better results than attempts to develop quantity indicators-for all the well-established reasons, such as heterogeneity within classes, likely correlation of price movements, etc. Further research and field work will no doubt pinpoint some additional industries that lend themselves better to quantification than to pricing - past development work has already established that finance, insurance, hospitals and government, among others, are best measured through quantity indicators.

Nevertheless, the majority of service industries appear to be more amenable to pricing.

Because of the diversity of services provided, different techniques would have to be used to develop suitable price indexes. For the more complex technical or professional services used by businesses, such as engineering design or consulting, the model pricing approach developed in the context of capital expenditure pricing would appear to be the most appropriate approach. With minor modifications, the technique, including the questionnaire developed for unique goods pricing, could be adopted for a wide range of services which appear to have defied measurement in the past. The examples developed are for engineering design services but the procedures would apply to architectural and other design services as well. With some further modifications, the same technique could also be applied to projects of an advisory or consultative nature.

Table I shows the distribution of revenues by type of service for consulting engineers for the year 1986. In total, the revenue for the industry amounted to $3.2 billion, with design services (C.P.C. 86722-86726) accounting for about $1.2 billion and exported services for over $300 million. The model pricing approach could, in principle, be applied to over 80% of the revenues.

In order to develop the proposed approach, it is necessary to disaggregate the C.P.C. categories so as to facilitate sample selection and weighting. Table II shows such a tentative disaggregation, based on the Canadian capital expenditure survey classes and the categories from the fee schedule for consulting engineering services prepared as guidelines by the associations of professional engineers.

There are essentially two main methods in Canada for charging for engineering design projects - (a) the cost plus method, which is based on estimates of the labour and other costs for a particular design project and adds a loading factor for overheads, etc., and (b) the percentage of "Works" method which is based on a percentage (varying with the nature and complexity of the design, and hence can be related to type or structure) of the final cost of the construction project. This latter method is more commonly used by architects than by consulting engineers in Canada. The model pricing approach is directly applicable to method (a), the cost plus method. (The assumptions and procedures are described in the Appendix). In cases where the percentage of Works method is used, it may be possible to draw on the existing price library for construction projects to ascertain the price change for the type of construction project and merely collect the rate change, if any, from the respondent.

This approach - and the C.P.C. as well as the major sub-headings - have been discussed with representatives of some of the major companies and the associations and appears to pose no problems in principle. Direct collection of the C.P.C. categories will be attempted for the reference year 1989. Further discussions with industry representatives are scheduled. Experimental field tests of the model pricing approach would have to be undertaken for subsequent periods.

TABLE 1

CONSULTING ENGINEERS, ISIC 7421, (PART), for 1986

CPC		%
8672	Engineering Services	
86721 -	Advisory and Consultative engineering services	32.5
86722-26	Engineering design services	36.6
86727 -	Engineering services during the construction and installation phase	14.4
86729 -	Other engineering services	2.8
8673 -	Integrated engineering services	4.8
	Total Engineering services	91.0
8650-60	Management Services	9.0
-	Other	
	Total Revenue, 1986, =	100.0

TABLE 2
ENGINEERING DESIGN SERVICES

(86722 - 86226)

C.P.C. Code	C.P.C. Title/Supplementary Headings
86722	Engineering Design Services for the construction of foundations and building structures for:
1	Residential buildings
2	Industrial buildings
- 1	Simple
- 2	Complex
3	Commercial buildings
4	Institutional buildings
5	Other building structures
86723	Engineering Design Services for the construction of mechanical and electrical installation for buildings
1	Conventional plumbing and heating, lighting and power distribution and exhaust ventilation, for simple industrial and commercial structures
2	Plumbing, hot water, steam or electrical heating, power distribution and lighting, air conditioning without ductwork for:
- 1	Complex residential, commercial, and institutional buildings
- 2	Extremely complex institutional industrial and commercial buildings
3	Full ventilation systems, air conditioning with ductwork for induction or all-air systems, refrigeration for all types of buildings
4	Other

ENGINEERING DESIGN SERVICES

(86722 - 86726)

C.P.C. Code	C.P.C. Title/Supplementary Headings
86724	Engineering Design Services for Civil Engineering Works
1	Dams, irrigation and marine construction
- 1	Reservoirs, retaining walls, embankments, riprapping
- 2	Irrigation and land reclamation project
- 3	Dredging and pile driving
- 4	Dyke construction
- 5	Docks, wharves, piers, terminals, breakwaters
- 6	Canals and waterways
- 7	Other
2	Roads, highways, bridges, tunnels, railways and airport runways
- 2	Bridges, trestles, overpasses
	1 Simple
	2 Complex
- 3	Tunnels
- 4	Rail track and roadbeds
- 5	Highways, roads, streets, including logging roads
- 6	Runways, including lighting
- 7	Other
3	Waterworks and sewage systems
- 1	Waterworks - trunk and distributing mains
- 2	Other waterworks construction
- 3	Sanitary and storm sewers, trunk and collection lines, open storm ditches and laterals
- 4	Sewage systems, disposal plants and connections
- 5	Other

ENGINEERING DESIGN SERVICES

(86722 - 86726)

C.P.C. Code		C.P.C. Title/Supplementary Headings
86725		Engineering Design Services for Industrial Process and Production
	1	Industrial plants and facilities, including mining
	2	Industrial processes and systems, including forest extractive and agricultural
	3	Environmental engineering, including waste disposal and treatment
	4	Other
86726		Engineering Design Services, n.e.c.
	1	Product development
	2	Accoustical and vibration engineering design
	3	Control systems design
	4	Other

A P P E N D I X

USE OF MODEL PRICE COLLECTION IN PREPARING DEFLATORS FOR SELECTED SERVICE INDUSTRY OUTPUTS.

ASSUMPTIONS:

The surveys which collect the current dollar value of outputs for establishments engaged in providing architectural and consulting engineering services would provide the source for a detailed classification of service outputs.

DEFINITION OF MODEL FOR PRICING PURPOSES (Establishment specific)

Within a service specific revenue category the respondent selects a recent, completed design (project) with the aim of representing the type and scale of work which they have undertaken in the reference year and in a field in which they expect to continue to be active.

The selected job usually will require some simplification to eliminate non-standard activities, or activities which would not be performed on such projects in the future. These could be related to changes in applicable standards, legislation, or simply usual practice by the firm. It also permits the elimination of unnecessary duplication of repetitive tasks by aggregation to a more standardized format. Thus completeness of the selected model is not compromised to any large extent while reducing the final form of the specification.

This stage constitutes identification of a fixed specification of activities in terms which satisfy the functional demands of the job and provides a list of factor inputs necessary to their performance (labour by type and quantity, equipment used, methods employed, etc.).

A complete concise project definition and summary of factor inputs will permit the respondent to estimate a hypothetical current period price which would in their opinion be the successful bid if the project as defined were being let under current market conditions.

This statement should include the usual contract bidding components (firm price, cost plus, percentage of project construction cost, etc.) and other relevant terms and conditions which would materially affect the bid estimate.

Experience suggests that it is advisable to obtain drawings and detailed specifications of the project.

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DEFINITIONS FOR UNIQUE PRODUCTS PRICING

DÉFINITIONS RELATIVES AU RELEVÉ DE PRIX DE PRODUITS UNIQUES

The estimated selling price is to be based on an analysis of prevailing materials prices and price rates in relation to materials and labour required to produce and supply the product as specified. It follows from this that the list of materials you establish should be priced out using appropriate prevailing price levels. The labour cost should be estimated on the basis of prevailing labour production costs for the type of design chosen. However, if the product could be produced in, say, 1979 more efficiently than in 1978, in that fewer man hours are required to produce the same element, the man hours by which wage rates are multiplied should be adjusted downward by the appropriate amount.

The direct cost (sum of materials, total labour costs and capital used costs) is to be modified by factors for other expense such as overheads, indirect expense and profit so that the resulting estimated bid reflects what the firm would have bid if the firm intended that the order was to be won and incorporated in its current schedule of production. The modification factor for profit should reflect current conditions encountered by the firm in making sales in the Canadian market for the class and volume of work implicit in the specifications of the model. It is important to remember that the specific job chosen is representative of a range of types & sizes of jobs.

It is to be assumed that the contract was let and completed during the reporting period. Thus materials, wage costs and overheads would represent levels prevailing during the reporting period and it would not be necessary to include in the contract escalation estimates for changing price levels. The estimate for profit should reflect the market competition prevailing during the reporting period.

Le prix de vente estimatif doit être basé sur une analyse des prix courants des matériaux et des taux de salaire par rapport aux matériaux et à la main-d'oeuvre nécessaires pour fournir le produit spécifié. Il s'ensuit que vous devrez indiquer sur votre liste de matériaux les niveaux appropriés des prix courants. Vous estimerez le coût de la main-d'oeuvre d'après les coûts actuels de production du genre de construction choisi. Toutefois, si le service peut être produit plus efficacement en 1979 qu'en 1978, par exemple moins d'heures-hommes pour produire le même élément, il conviendra de réduire en conséquence le nombre d'heures-hommes par lequel on multiplie les taux de salaire.

Le coût direct (c.-à-d. la somme des matériaux, des coûts de main-d'oeuvre et des coûts du capital utilisé) sera modifié par certaines variables afin de tenir compte des autres dépenses comme les frais généraux, les frais indirects et les bénéfices de façon que la soumission estimative finale reflète ce que l'entreprise aurait présenté si elle avait réellement voulu décrocher le contrat et l'inclure au nombre des travaux courants de son calendrier de production. La variable relative aux bénéfices doit traduire la conjoncture qui existait au moment où l'entreprise effectuait des ventes sur le marché canadien pour la catégorie et le volume de travail que représentaient les spécifications du modèle de contrat. Il importe de se rappeler que le travail spécifique choisi est représentatif d'un éventail de travaux de nature et d'importance variées.

On suppose que le contrat a été adjugé et terminé au cours de la période de déclaration. Ainsi, les matériaux, le coût des salaires et les frais généraux représenteraient les niveaux observés pendant cette période, et il ne serait pas nécessaire d'inclure dans le contrat des estimations indexées par suite d'une variation des prix. L'estimation des bénéfices reflétera le niveau concurrentiel du marché au cours de la période de déclaration.

Name and phone number of person to answer questions about this schedule:

Nom et numéro de téléphone de la personne habilitée à répondre à toute demande concernant ce questionnaire:

5-4303-41: 17-10-80

1. Name, company and address of the respondent :
Nom de l'enquêté et nom et adresse de la société :

2. Description of the project selected :
Description du projet choisi :

3. Location of the hypothetical jobsite :
Emplacement du chantier hypothétique :

4. Identification of the range of types and sizes of jobs to which the bid relates :
Identification de l'éventail des travaux selon la nature et l'importance compris dans la soumission :

5. Product group into which the project fits :
Groupe de produits visé par le projet :

6. The estimated bid to be entered below has the following further conditions attached.
Conditions additionnelles liées à votre soumission estimative présentée ci-dessous

7. Period bid relates to
Période de la soumission

8. Quantity of the order :
Quantité de la commande :

9. Value of the order/contract :
Valeur de la commande :

10. Value of Field work :
Valeur des travaux sur le terrain :

11. Sum of 9 and 10
Somme de 9 et 10

12. Federal Sales Tax :
Taxe de vente fédérale :

13. Provincial Tax :
Taxe provinciale :

14. Value of new bookings for the product group :
Valeur des nouvelles commandes pour le groupe de produits :

The following information is sought to provide insight into prevailing market conditions. Space is provided opposite 19, which can be utilized to amplify questions 15 to 18 or to explain conditions for which questions 15 to 18 may not be appropriate.
Les renseignements suivants visent à connaître l'orientation du marché. La rubrique 19 sert à commenter, s'il y a lieu, les questions 15 à 18 ou à expliquer la raison pour laquelle une de ces rubriques n'a pas été répondue.

15. Estimated proportion of the establishments normal capacity utilized during the period.
Taux estimatif de la capacité productrice normale de l'établissement utilisée pendant la période.

16. Estimate of your establishments share of total new domestic bookings for the group during the period.
Part estimative des nouvelles commandes au pays que votre établissement a reçues en ce qui regarde le groupe de produits pendant la période.

17. If significant orders were received from an area beyond which the establishment usually bids, please explain.
Si l'établissement a reçu des commandes importantes à l'extérieur de son territoire habituel d'activité, veuillez expliquer.

18. If any large unusual orders occurred during the period which fell outside the range and sizes of jobs specified in 4 above, please describe briefly the characteristics of the orders and their effect, if any, on bids falling within the range, specified in 4 above.
Si votre établissement a reçu des commandes exceptionnellement importantes au cours de la période dont les caractéristiques diffèrent de celles des tâches mentionnées au nº 4 ci-dessus, veuillez décrire brièvement les caractéristiques de ces commandes et leur influence, le cas échéant, sur les soumissions qui entrent dans l'éventail de travaux indiqués à cette rubrique.

19. Other significant market conditions prevailing during the period which have a bearing on the reported price.
Autres facteurs importants du marché qui ont influé pendant la période sur les prix indiqués.

Answers to the following questions will assist Statistics Canada respiwers to assess the validity of the price returns. Unusual changes, or the lack of changes, or inconsistent patterns of change among respondents often signify such things as design changes, unusual market conditions, or errors in reporting which need to be discussed with individual respondents to ensure the validity of data provided for price index purposes.

Les réponses aux questions suivantes aideront les spécialistes de Statistique Canada à établir la valeur des relevés de prix. Des changements inhabituels, aucun changement indiqué ou des tendances contradictoires chez les enquêtés signifient souvent un changement de modèle, une conjoncture exceptionnelle ou des erreurs de déclaration qui doivent être éclaircis avec chaque enquêté afin d'assurer la validité des données fournies dans le cadre de l'indice de prix.

20. Components of the bid
Éléments de la soumission

21. If important changes in materials used or in techniques of production occurred during the period please explain the changes.

Si des changements importants des matériaux utilisés ou des techniques de production se sont produits pendant la période, veuillez expliquer ces changements

22. If the model transaction is no longer representative of new orders being received by the establishment please outline the changes which need to be made.
Si la transaction modèle n'est plus représentative des nouvelles commandes reçues par l'établissement, veuillez exposer les changements qui s'imposent.

SAMPLE MODEL: BRIDGE, SIMPLE

(Drawings attached – supplied by OECD/EEC Purchasing Power Parities Project)

CLASSIFICATION:

C.P.C. Class	86724	Engineering Design Services for the construction of civil engineering works
	86724-2	Roads, highways, bridges, tunnels, railways and airport runways
	86724-2-2	Bridges, threstles, overpasses
	86724-2-2-1	Bridges, simple

VARIETY TO BE PRICED:

Precast concrete bridge, span of 20 metres, (simple structure)

Procedure:

1. Identify company from survey of consulting engineers
2. Contact company, inform them of survey and set up visit
3. Visit company and inform them of the necessity, usefulness and methodology of the survey.
   First, establish the following:
   a. Normal type of work projects
   b. Usual method of submitting proposal and usual contract with owner
      e.g. 1. Firm price
           2. Percentage of construction contract
           3. Cost plus
           4. Any variant of the above

      Note: Try to establish the percentage importance of each of the above for that year and in the preceding years.

   Secondly:
   a. Select a typical project that the company has obtained or might have obtained but has submitted a proposal for
   b. Obtain a copy of the drawings and specifications of this 'typical' project
   c. Have the company set up a file on the figures they used in the production of this proposal (which in this case is a firm price)

4. Survey company in subsequent years to update what they would charge for the same project in succeeding time periods

Possible problems:

1. Change in construction materials, techniques, by-laws, etc. necessitating a revision to the design. (Canadian experience in other construction areas indicates that ten years is a reasonable life span for a model)
2. Change in design techniques and presumably changes in productivity, e.g. introduction of CAD (computer aided design) systems
3. Change in product mix of the company being surveyed
4. Change-over in personnel in company and possible confusion in what figures are to be reported.