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PRODUCER PRICE INDEX FOR COMPUTER SERVICES IN SWEDEN

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Introduction

In Sweden, as in many other countries, computer services are an important part of the total production of services. Accordingly, the National Accounts have given high priority for the development of a price index for this area. Development work in Sweden began in 2001. The structure of the industry in Sweden was studied, international experiences were collected, the industry organisation and larger enterprises in the industry were contacted and visited. In cooperation with the enterprises, the most lucrative and in-demand services were selected and a pre-survey was carried out at the end of 2001. Price collection began in 2002. The purpose of this paper is to briefly describe pricing methods currently used, the difficulties encountered and plans for future work in the field.

Classification

According to NACE, Statistical Classification of Economic Activities in the European Community, Rev. 1.1 Code 72 Computer and related services are classified as:

72.1 Hardware consulting
72.2 Software consulting and supply
72.3 Data processing
72.4 Data base activities
72.5 Maintenance and repair of office, accounting and computing machinery
72.6 Other computer related activities

NACE code 72 corresponds to ISIC, International Standard Industrial Classification of All Economic Activities, Rev.3.1 code 72, Computing service activities.

Many times, the service is a combination of two or more of the above-mentioned categories. However, usually small enterprises handle either computer consulting or repair and maintenance services only. On the other hand, enterprises that also offer facilities management services are mostly somewhat larger enterprises. In many cases there are no clear-cut definitions between the various service areas but, rather, services consist of a complete package of services where specialists in different areas cooperate together.

The Swedish computer services industry

According to Swedish Business Statistics, there were over 20 000 enterprises in the Swedish computer services industry in 2000. These enterprises employed approximately 85 000 individuals and the total net turnover was SEK 109.3 billion. Sole traders accounted for 2.0 per cent of the net turnover in 1999. 95 per cent of enterprises were small with fewer than 10 employees. According to the intermittent survey of IT consultants during spring 2001, the 13 largest enterprises accounted for one fourth of the total turnover in the industry. More than half of the computer services enterprises were located in or close to one of the three largest Swedish cities. In terms of customers, enterprises and public utilities accounted for ¾ of the total turnover while households only accounted for 0.2 per cent. Government and municipal authorities accounted for 14 per cent. Software consultancy was the sub-sector with the largest share of

enterprises, employees, net turnover and value added in relation to the total value for each of these variables.

The last couple of years have been fairly difficult for the computer consulting industry in Sweden. However, the industry now believes that the situation is slowly improving again. The market is still weak but stable. Demand is expected to increase and prices to stabilise. A more significant upturn in the economy is needed for the industry to be able to grow. However, before this happens, it is expected that there will be more bankruptcies and mergers to attempt to adapt the services offered to demand.

Despite the harsh situation in the market, there are still companies that are doing well and growing, mainly those with advanced or niched services and products. There is less and less demand for simpler services, such as building websites. To survive in the market, it is necessary to be big enough to take over a company's entire IT department and be able to guarantee both stability and quality. The alternative is to run a smaller but more specialised operation and, in this way, to be able to offer services as a sub-contractor to a larger consultancy or to IT departments of larger enterprises.

Many enterprises concentrate on improving skills within their own organisations instead of hiring external consultants. Larger enterprise groups sometimes have their own companies that only sell computer services to other companies in the enterprise group. These services are not usually evaluated at the market rate.

Industry output

Computer services are often quite complicated and uniquely adapted to the needs of the customer. Different types of services are combined in various ways and tailor-made for the customer, thus making it difficult to define the service. Large computer enterprises often offer most services available within the industry.

Computer consulting services include the development, analysis, design and programming of software, adaptation of existing software, system integration services and assistance to keep computer systems in good working conditions.

Facilities management services consist of the provision of personnel to manage and operate client-owned computer facilities on an on-going basis, database services and data processing services.

CPA 72.5 consists of the maintenance and repair of office and computing machinery. The largest source of income for computer services enterprises is the maintenance and repair of computers, printers and servers. Maintenance services refers to the servicing of computers, etc. during the time period specified in the service agreement. Repair services, however, refers to the repair of machinery with problems after the period covered by guarantee is finished.

Service agreements for maintenance services for enterprises are often between one and three years long, and machinery is repaired and services carried out whenever needed during this time. The period covered by guarantee for private customers is often one year. Thereafter, a price is paid per repair.

Sample selection

Sweden's Business Register is used as a sampling frame. Enterprises that have the relevant activity as a second or third line of business are also included in the sampling frame. This is because an enterprise can have a NACE category as its main line of business at the same time that it is a major enterprise within another NACE category.

In Sweden, twenty per cent of the enterprises are replaced and the weights are updated annually. However, the largest enterprises are always included in the sample.

The total sample size is 120 enterprises, with 790 price quotations. The sample size for each NACE group is proportional to the NACE group's weight according to the National Accounts.

Over the last few years, as a result of the economic recession, a great number of computer consultants have been made redundant. At the same time, it is quite easy and inexpensive to start a computer consultancy enterprise, which has meant that many consultants have started their own enterprises to avoid unemployment. It is, however, difficult to survive as a sole trader and many enterprises disappear relatively quickly. For this reason, sole traders are removed from the frame and we apply a cut-off limit of ten employees for all samples for computer services. The inclusion of these enterprises would increase the risk of non-response. The cut-off limit is also motivated to help reduce the response burden on small enterprises.

As the computer industry is very changeable, it is suitable to frequently draw new samples and update the weights between enterprises and services within enterprises. For consultancy services, a new sample of enterprises is drawn annually.

It is more difficult to identify the enterprises working with facilities management services, so a new sample is drawn only every three years. In case some enterprises have been excluded from the sample during the year, the sample is complemented with new enterprises at the end of the year. Drawing a whole new sample more frequently would increase the risk of non-response.

A new sample of enterprises working with repair and maintenance of computers is drawn every other year. This market is more stable than the other two and, therefore, it is not motivated to draw a new sample every year.

Since the computer services industry consists of many small enterprises, the samples are drawn using a probability sample. Probability sampling makes it possible to use statistical theory to study the properties of the estimates. An order πps design sample with size measure *s* "number of employees plus one" is drawn from the relevant NACE group. For an enterprise active in multiple sectors, the size measure is multiplied by the share in the relevant sector. "Number of employees plus one" is used as the size measure since the number of employees is a more stable variable than net turnover, which is missing for a number of enterprises and is often out-of-date in the business register. For enterprises active in several sectors, the size measure, *s*, is (share in the sector) * (number of employees plus one).

The correlation between the number of employees and net turnover is relatively high, which indicates that the number of employees is a reasonable proxy for net turnover. The approximation is better for larger enterprises than for smaller enterprises.

An order πps design[1] involves the following stages:

1. Decide the sample size and calculate the sample inclusion probabilities for each enterprise in the frame.
2. Create independent random variables, with uniform distribution at intervals [0,1] for each enterprise.
3. For each enterprise, ranking variables are calculated by dividing the random variable by the respective sample inclusion probability.
4. Rank the frame with the ranking variable in ascending order.
5. The sample consists of the units with the *n* smallest ranking variable values.

In practice, a sample is drawn which is somewhat larger than the sample size chosen in stage 1. In case of overcoverage, the sample becomes smaller as enterprises disappear. The disappearing enterprises can then be replaced by enterprises with the closest lowest ranking variable after *n* number of enterprises.

Weights

An enterprise's turnover is used as the enterprise's weight for the index calculations. In those cases in which data on turnover is missing, an estimated turnover is used. This is obtained by first calculating the turnover per employee for those enterprises for which data on both the number of employees and turnover are available. The number of employees in the enterprise lacking information on turnover is then multiplied by this factor. New weights are calculated annually.

Every personnel category today has the same weight in the index calculations, i.e. the hourly rate for systems developers, programmers and project leaders are given the same weight. For facilities management services, the enterprises are asked to give an estimation of what percentage of the price of an operational contract is, on average, for the supervision of servers, support services, supervision of data communication, data storage, back-up services and other components. However, the information received is of a very uncertain quality and it is therefore not used for index calculations. Instead all services are given the same weight. It is better to calculate an index without weighting, if the weights are of poor or uncertain quality.

Price measurement methods

Prices for computer consulting services as well as for maintenance and repair services have been collected since the first quarter of 2002. The collection of prices for facilities management services started half a year later.

Computer consulting services

This sector usually charges by the hour. We collect information on the average invoiced hourly rate for the following categories of consultants: project manager, systems analyst, IT architect/system designer, systems programmer/computer programmer and systems engineer. Each consultant category is divided into five different experience levels and the hourly rate for consultants at experience levels two to four are requested. Since most consulting assignments are fairly short (less than two years), we do not take the length of the contract into account. The hourly rate for programmers is affected by which programming language is used. We therefore ask respondents to report the programming language when reporting the hourly rate for programmers.

[1] For more detailed information about πps design see Annex A

Example:

Ex 1: Give the average invoiced price per debited hour, excluding VAT and travel costs, for systems analysts[2], expertise level 3[3].

Ex 2: Give the average invoiced price per debited hour, excluding VAT and travel costs, for systems programmers/programmers[4], expertise level 4[4].

Collecting data on realised turnover per hour or average hourly rates decreases the burden for the enterprises in comparison with model pricing and contract pricing. In addition, the data is often available in the standard accounting system. However, the method does not take changes in productivity into consideration, which may result in an upward bias in the price index. This is particularly problematic in a sector that changes so quickly; both software and hardware are constantly developing. In addition, an enterprise's knowledge base increases with the number of consulting assignments, which enables the quicker and more effective completion of future assignments.

By dividing up consultants into different categories of staff and experience levels, we try to measure prices at constant level of quality of services. It is important to include the effects of discounts, and thus it is not recommended to use listed prices. In most cases, a list of hourly rates rarely constitutes a reference for prices and are usually only charged by smaller enterprises. Furthermore, the price lists are generally only updated once a year.

Computer facilities management services

Operational contracts are often very complicated and uniquely formulated for each customer. Large enterprises sometimes have separate companies that internally take care of facilities management services. The disadvantages with contract pricing for consulting services described earlier also apply to facilities management services.

Specification pricing or model pricing can be used by first dividing up a contract into representative components and then measuring the prices for these components. However, since facilities management services are often priced as a package, some enterprises, especially smaller ones, may have difficulty in breaking down the contracts into detailed levels. This problem may be reduced in the future, since customers are now more often asking for detailed price information. An alternative is to use separate questionnaires for small and large enterprises, with a more detailed one for the large enterprises.

For facilities management services, we collect prices for support services, supervision of servers, information storage, supervision of data communication, back-up services and the placement of computers.

Example:

Ex 1: Give the average price per quarter for the supervision of your choice of server, with the highest security. Simple daily checks of the server should be included in the supervision.

Ex 2: Give the average price for storage of 1 GB unmigrated data per day.

[2] For a definition of systems analyst, see Annex B
[3] For a definition of expertise levels 3 and 4, see Annex B
[4] For a definition of systems programmers/computer programmers, see Annex B

Ex 3: Give the infrastructure cost per rack unit and per month for a computer in a computer room. Regulated temperature and humidity, electricity and connection to the network should be included.

Maintenance and repair of office, accounting and computing machinery

In Sweden, we collect prices for maintenance, repair and installation of computers, printers and servers. Model pricing is used for all these services.

The price for the maintenance of computers, printers and servers depends on, among other things, the market situation, internal costs, the product supplier, quantity, the length of the agreement, the response time, time of day/week, guarantee rules, new or old customer, place of business.

Both computers and printers become out-of-date very quickly and are replaced with newer models. This means that machine and model changes will happen relatively often. A two year old computer or printer is considered by the industry as old. The guarantee time for private persons is accordingly short, often only one year. Computers and printers for which new service agreements are written are, for the most part, only new models, and those which are repaired after the end of the agreement time, are mostly old models.

An example for price models:

Ex 1: Give the average price during the current quarter for the *service* of a commonly occurring *desktop computer*, 3-year contract. Problem reported weekdays 8-16, service within 4 hours. Large customer.

Ex 2: Give the average price during the current quarter for the *repair* of a commonly occurring *printer* (n.b. not colour laser printer). Large customer.

Ex 4: Give the average price during the current quarter for the *installation* of a commonly occurring *server*, 10 users. Large customer.

The enterprise itself chooses an appropriate model of computer, printer and server for price measurement. If the question does not directly apply to the enterprise's activities, the enterprise can choose the service that is closest.

Index calculation

The price index for **consulting services** are calculated in two stages:

1. The first stage is to calculate the *index for each enterprise,* I_i .

$$I_{0,i}^{t} = \frac{\sum_{s=1}^{n} P_{t,s}}{\sum_{s=1}^{n} P_{0,s}} \times 100$$

Where, $P_{t,s}$ is the price for specific service *s* in enterprise *i* at time period *t*.

$P_{0,s}$ is the price for specific service *s* in enterprise *i* at base period *0*.
n is the number of services for that specific enterprise

2. The second stage is to calculate the *total index for* ***consulting services****,* I , by weighting together the index calculated for each enterprise in the first stage.

$$I = \sum_{i=1}^{n} w_i I_i$$

For w_i , the following applies:

Let w_i^* be the actual weight of enterprise *i*. Let $w_1^* > w_2^* > \ldots > w_N^*$.
The sample inclusion probabilities are defined as follows:

$$\lambda_i = \frac{ns_i}{\sum_{j=1}^{N} s_j}, \text{ i=1,2,…,N}$$

where, *n* is the number of enterprises in the sample survey and
N is the total number of enterprises.

For enterprise 1, i.e. the largest enterprise, the weight is assigned as follows:

If inequality $\lambda_1^* > 0{,}9$ holds, then $w_1^* = w_1$

Let *k* be the number of enterprises which have been given their own weights, $w_k^* = w_k$.
Then the remaining *n* - *k* enterprises should be assigned with equal weights according to

$$w_i = \frac{\sum_{1}^{N} w_i^* - \sum_{1}^{k} w_i^*}{n-k}$$

The price index for **computer facilities management services** is calculated in three stages:

1. The first stage is to calculate the *index for each enterprise,* I_i .

$$I_{0,i}^t = \frac{\sum_{s=1}^{n} P_{t,s}}{\sum_{s=1}^{n} P_{0,s}} \times 100$$

2. The second stage is to calculate the *total index for each NACE category*[5]*,* I_j , by weighting together the index calculated by each enterprise in the first stage for each category.

$$I_{0,j}^t = \sum_{i=1}^{n} w_i I_{0,j}^t$$

[5] NACE 72.1, 72.3, 72.4 and 72.6

For a definition of w_i, see the index calculation for consulting services earlier.

3. In the third stage, the *total index for **facilities management services**, I,* is calculated by weighting together the index calculated for each enterprise according to the NACE category in stage two:

$$I_0^t = \sum_{j=1}^{M} w_j I_{0,j}^t$$

Where, w_j is the share of turnover within the NACE category the previous year and
M is the number of NACE categories

The price index for **maintenance and repair services** are calculated in two stages:

1. The first stage is to calculate the *index for the respective enterprise,* I_i. A geometric average has been chosen because of its ability to cope with disparate price levels.

$$I_{0,i}^t = \frac{\left(\prod_{s=1}^{n} p_{t,s}\right)^{1/n}}{\left(\prod_{s=1}^{n} p_{0,s}\right)^{1/n}} = \sqrt[n]{\prod_{s=1}^{n} \frac{p_{t,s}}{p_{0,s}}}$$

2. The second stage is to calculate the *total index for **maintenance and repair services***, I, by weighting together the index calculated for each enterprise in the first stage.

$$I = \sum_{i=1}^{n} w_i I_{0,i}^t$$

For a definition of w_i, see the index calculation for consulting services earlier.

Data collection

The questionnaires are sent to the enterprises on the first weekday after the end of each quarter and the response time is one month. A soft reminder, “We would like to remind you that the submission deadline is…”, is sent ten days before the submission deadline. Most of those who receive a “soft reminder” answer within a couple of days and we don’t need to send more than a few reminders after the submission deadline.

The respondents are able to receive and send the questionnaire either by post or e-mail. In the near future, the enterprises will also be offered the possibility of sending prices using an Internet questionnaire.

Quality adjustment

When measuring hourly rates for consulting services, it is important to break down the consultants into different categories of personnel and experience levels. By doing so, a constant level of quality of services performed can be maintained to the greatest possible extent. Today, we lack the tools to measure changes in productivity per consulting hour.

For maintenance and repair services, the enterprise itself chooses the most commonly occurring printer, computer or server models. In order to follow the price development, the chosen machinery and models should remain constant. The problem of quality adjustment arises when the computer, printer, or server model changes. The overlap method is used as a quality adjustment method. The method means that the value of the quality change of maintenance of a replaced computer model and replacing computer model is assumed to be equal to the difference in price between maintenance of the two models during a period when both models are available. When collecting prices for the base period, the enterprises are asked to check the chosen models and, if necessary, to change them.

Specific aspects

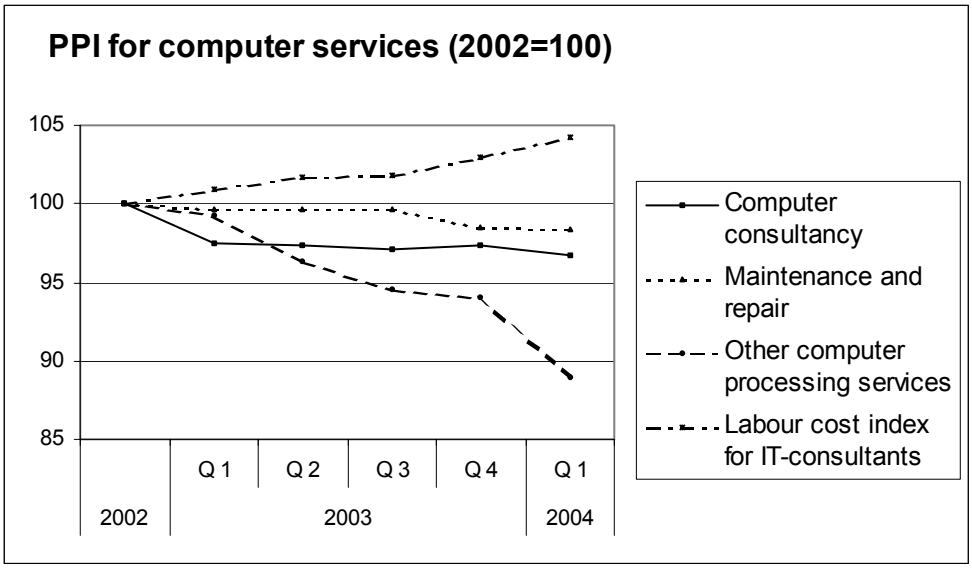
The computer industry is characterised by many rapid changes. Accordingly, it is important to closely monitor the existing indices at regular intervals. This is also true for samples and specification of services. In order to make a quality adjustment of the price index based on hourly rates, we need to develop methods to measure changes in productivity per consulting hour. This work is probably best done in close cooperation with enterprises in the industry.

Computer consulting services are often unique for each customer, and can be combined with facilities management and maintenance services. A contract is also complicated and detailed. Use of model pricing or contract pricing for these services involves a considerable burden on respondents. It could be feared that enterprises, to a large extent, then choose only small assignments for price measurement. A heavy burden on respondents can also lead to a lower quality of information received, as well as non-response. Estimating volumes based on virtual projects needed for model pricing is difficult. In addition, the model needs to be reviewed often, so that measured prices are up-to-date. This is especially important concerning industries that rapidly change their assortment of services. The problem with quality evaluation arises when a new contract is written, or when there is a change of customers.

Price development for repair services can sometimes depend on the chosen printer, computer or server model. When an enterprise notices that a certain model requires service and/or repairs more frequently than most other models, they raise the prices for service and repair for that particular model while their prices in general remain unchanged or are even reduced. The choice of model can therefore have a determining effect on the price index.

Results

Prices for all computer services have constantly decreased since the beginning of pricecollection in 2002. Price for facilities management services has decreased the most while prices for maintenance and repair services have been quite stabile. At the same time labour costs for IT-consultants has increased.



Producer price index for computer services, 2002=100					
Year		**Computer consultancy**	**Maintenance and repair**	**Other computer processing services**	**Labour cost index for IT consultants**
2002		100,0	100,0	100,0	100,0
2003	Q 1	97,5	99,7	99,3	100,9
	Q 2	97,3	99,6	96,4	101,7
	Q 3	97,1	99,6	94,6	101,8
	Q 4	97,4	98,5	94,1	102,9
2004	Q 1	96,7	98,4	89	104,2

Indices for computer services are published and delivered to the National Accounts approximately 45 days after the end of the quarter.

For consulting services and maintenance and repair services, object non-response is insignificant and partial non-response generally does not occur at all. However, non-response is larger for the collection of prices of facilities management services. For small enterprises, partial non-response is very large which indicates that it may be necessary to consider changing the methods of price measurement and/or the type of services for the smaller enterprises.

By using the simplest possible methods, the quality of response can be increased and non-response reduced. Personnel in the finance department fill in most of the questionnaires. These people may have trouble in evaluating quality without the help of personnel who have more understanding of the operations and services performed.

For facilities management services, a new sample is drawn only every three years. Still, in 2004, 25 per cent of the enterprises were replaced as enterprises had changed field, had ended the activity or were not able to break down their contracts into detailed levels.

Future plans/Summary

We, of course, try continuously to follow the trends and changes in service industries. Furthermore, we have as a goal to carry out a review of each index for services every three years, following a rolling timetable. Review of the current pricing methods for computer services is planned in 2005.

The review consists of an analysis of the structure of the industry, the chosen sampling method, cut-off limits and sample sizes. Furthermore, a review of the representative services and categories of services, price models and pricing methods is included. Even international experiences are studied. The current surveys may also be expanded with further sub-surveys.

Annex A Theoretical frame of reference

Sampling in general

We have a population with observation values (y_1, y_2, …, y_N), where N is the population size. An element in the population, an individual, is applied to estimate a total $\theta = y_1 + y_2 + \ldots + y_N$, using a sample with sample size n. There is a size measure (s_1, s_2, …, s_N) for all individuals, where s can be the number of employees or the net turnover of the enterprise.

The sample inclusion probabilities for individuals are π_1, π_2, …, π_N. This means that enumeration factor for an individual is $1/\pi_i$, which means that the chosen individual represents $1/\pi_i$ individuals, itself and $1/\pi_i - 1$ others.

To estimate θ, the Horvitz-Thompson (HT) estimator can be used
$\hat{\theta}_{HT} = \sum sample(y_i / \pi_i)$.

πps sampling in general

Given a size measure (s_1, s_2, …, s_N) for all individuals, the sample design is said to be of πps design if the sample inclusion probabilities, π_k, are proportional to s_k; $\pi_k \propto s_k$.

Given the sample size, n, the sample inclusion probabilities are defined as follows

$$\lambda_k = \frac{ns_k}{\sum_{j=1}^{N} s_j}, k = 1,2,\ldots,N.$$

To make an order πps sample, then $\lambda_k < 1$ for all k. Those individuals for which $\lambda_k \geq 1$ are excluded and put into a "take all" stratum[6]. Assume hereafter that $\lambda_k < 1$ for all k.

An order πps design[2] involves the following stages:
Stage 1: Establish the sample size and calculate λ_k for k = 1,2,…,N.
Stage 2: Create independent random variables U_k for k = 1,2,…,N with uniform distributions at the interval [0,1]. Ranking variables, Q_k are computed as follows;

$$Q_k = \frac{F(U_k)}{F(\lambda_k)}, k = 1,2,\ldots,N.$$

Step 3: Rank the frame with the ranking variable in ascending order. The sample consists of the units with the n smallest Q values.

If the function F is F(x)=x, which means that

$$Q_k = \frac{U_k}{\lambda_k}, k = 1,2,\ldots,N;$$

the sample is called a Uniform order sample πps, see Rosén (2001) or Sequential Poisson Sampling, Ohlsson (1990).

If function F is F(x)= x/(1-x), we have a Pareto πps sample. The variance for a Pareto πps sample is lower than that for a Uniform order πps sample and also for all possibilities of function F, see Rosén (1996) and Rosén (2000).

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[6] In practice, the enterprises where $\lambda_k > c$, are included where $c < 1$.
[2] Note that this sample design is only an approximate πps sample.

Application for price measurement
When a πps sample is used for price measurement, two estimates can be done. Either

$$\theta = I_{01} = \frac{\sum_i q_{i0} p_{i1}}{\sum_i q_{i0} p_{i0}}$$

or,

$$\theta = I_{01} = \sum_i w_i \frac{p_{i1}}{p_{i0}} = \sum_i w_i I_{i,01}, \text{ where } w_i = \frac{q_{i0} p_{i1}}{\sum_i q_{i0} p_{i0}}, i = 1,2,...N.$$

Here p is for price, q for quantity and *i*, individual, is for enterprise.

There are then two options for parameter estimation. In the first case, parameters are estimated as a ratio of the two estimates. In the second case, the parameter is estimated as a total.

Which is chosen depends on the way that the size measurement is to be interpreted. Is it a volume or a value?

If the size measurement is to be interpreted as a value, $w_k = \lambda_k/n$ for k = 1,2,…,N. In this case, $y_k = w_k I_{i,01}$. Here, it is a total estimation, HT estimator,

$$\hat{\theta}_S = \sum_{sample} \frac{y_i}{\pi_i} = \sum_{sample} \frac{w_i I_{i,01}}{\lambda_i} = \frac{1}{n} \sum_{sample} I_{i,01}.$$

indexed with S (sum) to differentiate it from the next case.

Practical consequences for price measurements
We assume that individuals respond independently of each other with the same response probability. If non-response occurs, the following non-response model can be used: When estimating θ_s, n can be exchanged for n´ which is the number of respondents. For θ_{kv}, no modifications are necessary.

A commonly occurring problem is overcoverage, enterprises which are included in the frame that cease production in that industry. This means that the sample becomes smaller as individuals are deleted. In addition, the sample probability is altered. One way to establish the sample size, n, is the following. Let n´´ > n.
Rank the frame according to the rank variable.
Take out the n´´ number first in the frame
Go down the list in rank order until n observations have been obtained.

Here the sample probabilities are altered, but they are still proportional to s. This means that the estimate does not change. However, it is necessary to check that the sample probabilities are still less than 1 for those individuals that are not included in the "take all" stratum.
This can be avoided if n´´ is not too large and if the "take all" stratum contains individuals where $\lambda_k > p$, where $p<1$. The figure p is called the Pareto limit.

Annex B

Definition of consultant categories

Systems analysts
Expertise to be able to plan and develop new information and computer systems or maintain and further develop systems in operation and compile program specifications. Prepare guidelines, program specifications and systems descriptions according to a customer's requirements. Coordinate work together with database designers, GUI (graphical user interface) developers, programmers, operation personnel and systems analysts of other systems. In an object-oriented development, the systems analysts is responsible for the shaping of the responsibilities in the different categories, i.e. operations.

Systems programmers, computer programmers
Concerning programming related to the mentioned systems development. Construction of a computer program by analysing and controlling the program specifications and forming programs in programming language, such as Visual Basic, C++, Cobol or Java. Work with the production of program codes, program testing and documentation. Take care of the development and testing of components in accordance with the overall project standard or standards. Have good expertise in programming language, frameworks and tools. Also have knowledge and preferably even the tools for testing.

Definition of level of expertise

Expertise level 3
Knowledge: Extensive knowledge in their area.
Experience: Three to eight years' experience as a consultant within the area. Have taken part in or carried out consultancy work. Can be responsible for one area and lead a group.

Expertise level 4
Knowledge: General expertise, deep or unique expertise within a limited technical area.
Experience: Have taken part in large projects within different areas and carried out projects of high quality. This level is normally reached at the earliest after seven to twelve years as a consultant in the area.