Industrial services in PPI

- Methods and applications of Swedish Producer and Import Price Indices -

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Abstract

Producer Price Indices (PPI) aim to measure the average price change within NACE A-D. This part of NACE mainly covers commodities but a few services are included, namely Industrial services. In general, measuring price fluctuations for services is known to be more time consuming and abstract compared to measuring fluctuations for commodities. As a consequence there has been a major lack in covering these prices in PPI so far. This report describes the process to initiate more observations in general and more qualitative observations specifically. New routines in handling Industrial services were developed during the project, not only in the sampling procedure but also in the process of collecting price quotations and in how to implement Industrial services in the index calculations.

Keywords: Producer price index (PPI), Industrial services

1 Introduction

The aim of Producer and Import Price Indices (PPI) is to present the average price trend in the producer and import stages, totally and for different product groups. The index is sub-divided into domestic market (DPPI), export (XPI) and imported goods (MPI). Services Producer Price Indices (SPPI) is a young sister product of PPI that regularly develop new indices for service industries under classifications G-O in SNI 2002 (Swedish Standard Industrial Classification 2002).

An ideal PPI should be based on goods/services (= products) that are clearly specified and representative for each individual company's activities within the selected service group. It should be possible to track the products over time and be able to adjust for any changes in quality. It is difficult to fulfil these criteria for services for the following reasons:

- The services are often unique, i.e. they are performed once for a particular customer and never again.
- Many of the service's qualitative factors are difficult to attach a value to. How should e.g. fast delivery be valued?

Since unique services are so common, a standardised measuring method designed for repetitive products can often not be used to measure price movements in the service sector. It is therefore often more difficult and more time-consuming to measure prices and as a result, undercoverage in the measurement of industrial services within PPI have been a problem for a long time. The aim of this project has been to examine the possibility of rectifying this undercoverage problem and encouraging more measurements in the area of industrial services.

This report has been organised as follows: Chapter 2, Work process, describes how the work has been performed and Chapter 3, International comparisons, describes how Industrial services are handled in other countries. The results of the desktop survey are presented in Chapter 4, Description of the industry. This chapter describes in more detail what is to be included in the measurements and how things look at the moment. Chapter 5, Methodology, addresses methodology issues, in particular focusing on measuring price movements on the services market. Finally, Chapter 6, Future surveys, presents what we believe requires extra attention in Industrial services.

2 Work process

Personnel with experience of PPI, as well as personnel from SPPI (services producer price index) at the Macroeconomics and Prices Department at Statistics Sweden have participated in this project. The idea behind this was that much of what is useful for the project can be learned from SPPI as regards price measurement methods and contact with service companies. At the same time, experience of practical PPI work is indispensable in order to effectively incorporate the measurements into current production. The best aspects of the working methods of both products can then be highlighted and there is also much to learn for existing surveys within both sister products.

When developing price indices for new/previously neglected areas, there are a number of possible sources that make the work easier. These are for example:

- Existing statistical sources, not only other departments at Statistics Sweden but also the Swedish Board of Customs, trade organisations and the like
- Statistics offices around the world that perhaps already produce price indices for the area in question.
- The industry, i.e. companies and trade organisations, has unique and vital information in order to understand what is to measured and how it can be measured.

The first step in the project was to conduct a desktop survey of existing statistical sources. The Business Structure Unit and the Foreign Trade and Industry Indicators Unit at the Business and Labour Market Department at Statistics Sweden and the Swedish Board of Customs were all contacted. This survey showed that it is a heterogeneous group of companies and services that the survey should cover. It is therefore difficult to find a price measurement method that fits all measurements. Furthermore, there is no common trade organisation. Individual solutions must be found for all companies.

Using the results from the desktop survey, it was decided that the next step would be to draw a sample and visit as many of the selected companies as possible to initiate measurements. Forms were designed before the visits took place utilising the experience gained from PPI and SPPI. The form was revised during the meetings so that those companies not visited could answer it as easily as possible. The original form was found to be too detailed and it was hence simplified. In order to cover all aspects of the service, space was left for further comments.

The project was initiated in April 2007. The first few months were spent on the desktop survey and on discussing the extent of the survey. The sample

was drawn at the beginning of August and many companies were visited during the autumn whilst the report was being written. Prices for December 2007 will be requested from all the companies in the survey in January 2008. These prices will be used as the bas for the 2008 calculations.

3 International comparisons

To gather the experience in this area from other countries, emails were sent out to prominent statistics offices throughout Europe. The conclusions from these contacts are primarily that many countries include Industrial services in PPI in the same way as Sweden has done previously, i.e. not to the fullest extent. Some countries have, however, come a step further in this issue. These are:

- *Portugal,* which has recently started a project similar to the one Statistics Sweden is currently undertaking. Portugal has also focused on a possible division between domestic market and import/export markets.

- Based on the Industry's production of goods, *Germany* selects the most important Industrial services that are to be included in PPI. The price measurement method is the same as that used for other goods included in PPI.

- *Hungary* currently only includes repair services within Industrial services in its PPI.

- As a consequence of the new NACE version[1] *Finland* currently recalculates the basis in PPI to 2005=100. Because there are more Industrial services in SNI 2008 than in SNI 2002, Finland will try to include Industrial services in PPI. This will be done with the help of the experiences gained in SPPI.

- *France* has also started to collect prices of Industrial services as a consequence of the NACE modification. Production will be tested during 2008 and will be ready in 2009. Similar to Finland, France is also utilising the experience gained in SPPI.

- *Switzerland* will probably start a project on Industrial services during next year.

[1] As from 2008, a new industry classification will apply. This classification has been drawn up by Eurostat and is adjusted slightly for each member state.

4 Description of the industry

This section is based on the desktop survey conducted at the start of the project. Figures from the Foreign Trade unit and the Business Structure unit (industry's production of commodities shortens IVP in Swedish) have been used.

4.1 Definitions

Industrial services are classified with a CN-number starting with 992, 993, 994 and 995[2]. After the commodity code follows a 5-digit SNI number classified under sections A-D in SNI 2002. Industrial services are therefore not included in SPPI that are intended to cover sections G-O. The different groups of services are:

992: repair and maintenance
993: contract processing
994: assembly and installation
995: other processing.

Several SNI are grouped under each 3-digit customs commodity code. Definitions of the various 99-groups and examples of what is included in these are listed below.

Repair and maintenance (992)
This includes repair and maintenance of aircraft and spacecraft, repair and maintenance of railway and tramway locomotives and rolling stock, repair and maintenance of engines and turbines, except aircraft, vehicle and cycle engines, and repair and maintenance of lifting and handling equipment

Contract processing (993)
According to the Swedish Board of Customs glossary, contract processing is defined as the processing (not repair) of a product that is not owned by the processor. Processing is performed according to a client's instructions, often regulated by a contract and usually against payment only for the processing costs.

Contract processing includes general mechanical engineering, treatment and coating of metals, copper production and the manufacture of pharmaceuticals.

[2] The customs nomenclature does not include the 99-level and hence does not include ”Industrial services”. 992-995 is Statistics Sweden’s construction to capture these parts of the economy.

Assembly and installation (994)
Assembly and installation includes e.g. assembly and installation of metal structures and parts of structures, assembly and installation of prefabricated wooden buildings and assembly and installation of other special-purpose machinery.

Other processing (995)
Other processing includes printing from commissioned printing houses and other processing of printed matter, casting of metals, forging of metals, treatment of metals , general mechanical engineering, design and assembly of automatic production facilities and recycling.

4.2l Turnover in the industry

Data from IVP for 2005 supplied to PPI prior to the 2007 sample are used as a basis for selecting the Industrial services. Table 1 shows their turnover values.

Table 1 *Turnover for the various groups of industrial services*

Group	**992**	**993**	**994**	**995**
Total value	25645	15078	7136	75393
Percentage of DPPI (%)	2.7	1.6	0.7	8

SEK millions 2005 (IVP)

Group 995, Other processing, is by far the biggest group followed by 992, repair and maintenance, and 993, contract processing. The smallest group is 994, assembly and installation. In all, the total turnover of Industrial services is about 13 percent of DPPI.

Table 2 shows the industrial services divided into 2-digit SNI and classified in descending order according to turnover. Metal products except machinery and equipment (SNI 28) are responsible for 35 percent of the total value of the industrial services. Publishing, printing and reproduction of recorded media is also a large group and is responsible for 20 percent of the total value. Other transport equipment and machinery (except computers) has been valued at 10 percent of total turnover. Steel and metal, instruments, photographic equipment and clocks/watches has been valued at five percent whilst the remaining 2-digit SNI groups are only responsible for small percentages.

Table 2 *Turnover for industrial services according to IVP, broken down by 2-digit SNI*

SNI-2	Description	Sample units	Value (SEK millions)	Percentage share (%)
28	Metal products, except machinery and equipment	16	43 386	35.2
22	Publishing and printing	12	25 345	20.6
35	Other transport equipment	7	12 438	10.1
29	Machinery, except computers, etc.	18	12 352	10.0
27	Steel and metal	10	6 340	5.1
33	Instruments, photographic equipment, clocks/watches	5	6 153	5.0
37	Recycling	2	5 657	4.6
15	Food products and beverages	17	2 243	1.8
25	Rubber and plastic products	5	1 817	1.5
31	Other electronic machinery and equipment	5	1 746	1.4
20	Wood and products made of wood (except furniture)	8	1 232	1.0
24	Chemicals, chemical products, man-made fibres	6	1 080	0.9
32	Radio. television and communication equipment and apparatus	3	1 029	0.8
26	Production of mineral substances	5	682	0.6
34	Motor vehicles and trailers	3	633	0.5
17	Textiles	10	500	0.4
36	Furniture and other manufactured products	7	219	0.2
14	Other mineral products	2	179	0.1
21	Pulp, paper and paper products	3	161	0.1
10	Coal and peat	1	23	0.0
30	Office machinery and computers	1	18	0.0
19	Leather, leather goods and footwear	2	16	0.0
18	Clothes, including clothes made of fur, skin and leather	1	2	0.0

SEK millions 2005 (IVP)

4.3 Current measurements

A similar project was implemented in 2003, which dealt with this part of PPI and a number of price measurements was initiated for Industrial services. There are currently (as of December 2007) 23 measurements of Industrial services in DPPI. All come under CN-number 992 (repair and maintenance) and many observations are hourly prices for e.g. service work. In DPPI, almost two measurements are made per billion turnover. For Industrial services just under 0.2 are made. There is a substantial undercoverage in Industrial services.

It is also a disadvantage to use hourly prices since this price measurement method tends not to pick up productivity improvements but instead shows them as price increases. For more information on this, refer to Chapter 5.2.4. On the other hand, there is often no alternative to this price measurement method and it is inevitable that some measurements in Industrial services will consist of hourly prices. It is important to be watchful of productivity changes. The issue of alternative price measurement methods is further discussed in Chapter 5.2.

Table 3 Measurements in Industrial services in PPI 2007

Statistical number	**Product description**
99229220	Servicing work, hourly price
99229220	Complete full service agreement for residential lifts, 6 floors
99233200	Workshop/service engineer, hourly price
99229430	Mechanical assembly/disassembly of stores, hourly price
99235300	Standard work when disassembling and assembling PW4000 engines, hourly price
99235110	Repair work, hourly price. Framework agreement with the Swedish Armed Forces
99228300	Project engineer, hourly price
99229120	Service, hourly price
99235200	Regular workshop maintenance of goods wagons, hourly price
99235110	Dry-docking of boats, 35-40 feet
99229550	Service and maintenance of paper-making machinery
99229110	Chief fitters, hourly price
99229569	Loading and inspection of fire extinguishers 6-8 kg, article number 5657
99235300	Sheet metal workers, aircraft repair, hourly price and consumption parts, hourly price
99229120	Servicing work
99229510	Electricians, hourly price
99229230	Service, diesel-driven cars 98-0301000
99233200	Service contract SMA, standard contract
99229569	cross-cutting, bandsaw, hourly price
99229569	Mobile processing, milling and turning at customer's workplace, hourly price
99235110	Docking of sea vessels
99235110	Welding of sea-vessel components, hourly price
99235200	Engineering works on cost-plus contract, hourly price

4.4 Export and import

Import of a service in PPI/SPPI is defined as a transaction where the purchaser of the service is a Swedish company and the service provider is a foreign company. It is very difficult to ask customers for prices of repetitive, constant services. Since the alternative of asking foreign sellers is impractical due to difficulties in locating them and the fact that they are not bound by the obligation to provide data, imports are not included in the measurements.

When drawing the sample, only three observations were in the export market, which suggests that exports of Industrial services are responsible for only a very small part of the economy. It is perhaps more likely that this is a result of a shortage in the existing statistics used as a sampling frame. It is difficult to capture these transactions as no goods physically pass over the border. It is decided until further notice not to initiate any measurements of export prices and, to begin with, the only thing measured in Industrial services are price movements on the domestic market.

5 Methodology

Many method issues are not very different for Industrial services in comparison with other PPI and for a more general review of method issues for SPPI, please refer to the *Producer Price Index Manual: Theory and practice*[3].

5.1 Sampling, weights and collection frequency

Excluding services, 1600 measurements are made to cover weights of about 810 billion[4] in the domestic PPI. This gives nearly two measurements per billion. The aims for Industrial services is a sampling frequency of approximately half that. The reason is that Statistics Sweden is trying to reduce the respondent's burden. Price measurements in service industries are often more time-consuming, Y is why this size of sample has been chosen to start with. Another advantage is that Statistics Sweden can devote more time to each respondent, which should lead to higher-quality observations on our part. This smaller sample means that every measurement is given a larger weight than it would have been given in a full sample; every measurement represents a larger share of the turnover. As with other PPIs, a Πps-sample is used when drawing the sample. Sampling methods are discussed in more detail in *The process of updating the sample for the Swedish Producer and Import Price Indices* from December 2006.[5]

Because price measurements in service industries are often more time-consuming for both the respondent and for Statistics Sweden, prices will only be collected once a quarter. This is in line with how prices are collected for SPPI but is different from other PPI, which collect prices once a month. In Industrial services, the first month of each quarter represents the entire quarter.

5.2 Price measurement methods

To obtain the price movement for a product, there are a number of different price measurement methods. Since services are often unique, i.e. they are performed once for a particular customer and then never again, the standard case cannot be used very often. Alternative price measurement methods are described below.

[3] Producer Price Index Manual: Theory and practice. www.imf.org
[4] Turnover year y-2 is converted into the price level in December year y-1
[5] The process of updating the sample for the Swedish Producer and Import Price Indices, www.scb.se

5.2.1 Direct use of prices for repetitive services

1a. Standard case
If the service does not change over time and is repeated every quarter, it is ideal to follow the price of this service. List prices can be used if they reflect actual transaction prices. Any discounts on list prices should also be included.

1b Contract pricing
This method is only used when a service is repeated (almost) exactly the same by the same producer for the same customer several periods. In this method, it is important to be alert to quality adjustments when a contract expires and is replaced by a new one. Major price movements often occur at this time. Quality adjustments will be discussed in more detail in Chapter 5.3.

5.2.2 Unit value

In this method, the service is divided into homogenous sub-groups, for which turnover and quantity data are available. Prices for the various sub-groups are then estimated by dividing turnover by quantity. Unit value can be used together with time-based methods (see Chapter 5.2.4). The price calculation then comprises the number of hours worked (for the customer) for a number of clearly specified professional categories and the turnover for each category respectively.

A detailed specification of the group is needed, since there may otherwise be factors other than the price that affect the price index. There is, however, a risk of it being difficult for the respondent to find similar services the following quarter if the specification is too. These problems need to be balanced against each other.

5.2.3 Model pricing

Model price measurement is a suitable method for industries dominated by unique services. It requires the respondent to state a price in each period for a commonly occurring service, the specification of which remains constant. The service need not have been performed at the time data is collected. It is sufficient for the respondent to be able to make an estimate of the price.

When estimating a price, the following factors should be considered:

- Labour costs (staff by skill/experience level and number of hours)
- Overhead costs
- Gross profit margin (the representative margin that would apply in the current climate of competition).

The respondent must "reprice" each component for every new period. It is of extra important to re-estimate labour costs in order to detect productivity changes. A model can e.g. be based on a contract performed in the previous period.

One problem with this method is that it is very time-consuming, both for the data provider and for Statistics Sweden. It takes time to build up the models and the estimation is difficult to do, especially in industries in which negotiations often take place. Another problem is that some uncertainty arises in the price indices in the form of subjectivity. Perceived and actual price change are often different and it is probably not uncommon for the producer to feel that prices are decreasing whilst the purchaser feels they are increasing.

5.2.4 Time-based methods

This method is different from the others in that the price of the definitively delivered service cannot be identified. Instead, the time it takes to produce the service is used as a measure. The problem with this method is that productivity improvements are difficult to detect and there is a risk that this shows up in the price index as a price increase instead. If for example more efficient working methods lead to more work being performed per hour and the price is therefore increased, there is a risk that this will not be detected when collecting prices. This means that two different products are compared (the content of a worked hour has changed between the two periods of comparison) and it is difficult to determine what is a price change and what is a quality change.

5.3 Quality adjustments

When a product is no longer sold or is no longer representative, it must be replaced by a new product. It is then inevitable that the old and the new product are not identical and some sort of quality adjustment must be performed. In a quality adjustment, everything that is not purely price changes is purged from the submitted price data. This may, for example, be that the price data is for a larger volume, that other delivery terms have been negotiated or that a more qualified professional has performed the service. The same quality adjustment methods are available for services as those available for goods. In practice, however, fewer methods are suitable for services and the applicability of different methods varies between goods and services.

The most common quality adjustment methods that may be of interest as regards Industrial services are listed below. All are not ideal but sometimes, practice must take precedence over theory. The description of the different

methods has mostly been abridged from the PPI manual[6] and the SPPI manual[7].

5.3.1 Link-to-show-no-price-change

An assumption is made that all price change is commensurate with quality change and price indices as a result remain unchanged. This method is a solution when it is not possible to obtain any price information either for the old product after it has been replaced with the new one or for the replacement product prior to the replacement being made. Furthermore, it is not possible to determine what proportion of the difference in price depends on quality differences and what proportion is actually price movement. The method gives unwanted stability to price indices and Eurostat advises member states not to use this method automatically.

5.3.2 Direct comparison

Here the respondent may select a replacement product which is as similar as possible to the old product and all price changes are considered free from the influence of quality changes. The method means that we avoid making quality adjustments. This method lends itself to a distorted specification of the product and the respondent's skill and desire to choose a suitable replacement product. Caution is needed since small, inevitable quality changes distort indices in the long run. This is particularly true if the quality changes all go in the same direction, as is the case with the technological development of a product.

5.3.3 Overlap method

To use this method, price data on both the new and the old product are needed at an overlapping point in time. The method is based on the law of one price, i.e. that the entire price difference between two products at any one time depends on differences in quality. A number of objections can be voiced against the law of one price; e.g. that it is based on the premise that the seller has no scope for price discrimination. For most of the industries in the service sector, this assumption is not valid since large customers can often negotiate a more beneficial price. Other weakness of the method is that results depend on when the overlapping is done and that the price relation between the products is not constant over time (which, among other things, has to do with where the products are in the product cycle). This makes the method rather arbitrary. This is a particular problem on markets that undergo rapid technological development, where the price of goods falls quickly throughout the product cycle. Neither is the method suitable if we are following the price of contracts and the major price movements occur when

[6] Producer Price Index Manual: Theory and practice. Website: www.imf.org
[7] Methodological guide for developing producer price indices for services. Website: www.oecd.org

the contract is renegotiated and the scope of the service is simultaneously modified.

5.3.4 Adjustment after expert judgements

In this approach, a number of experts on the product, preferably from different backgrounds, assess the quality differences between the old and the new product. One variant is the "Delphi method", where the experts make their assessments separately so as to avoid being influenced by each other. They can then read each others' conclusions, have the chance to explain deviations and revise their assessment. The median assessment made after adjustment is used to determine how large the quality difference is deemed to be. This is a suitable method when it is a question of a complex product of considerable importance, for which other methods are not suitable. The method takes a long time and is costly and is perhaps not applicable to Industrial services in its most advanced form. A considerably simpler and more resource-efficient variant of this method is to discuss the problem with the data provider who is no doubt well-informed about the industry.

5.3.5 Quantity adjustment

Quantity adjustment is applicable when the replacement product is of a different quantity to the old one but is otherwise the same. Quality adjustment of the service can be done by correcting the price using the ratio of quantities. One problem with the methods is that it does not take account the change in unit cost in production when the quantity is changed, e.g. due to economies of scale, less packaging costs, etc. The method is therefore more suitable if the changes in quantity are relatively minor.

5.3.6 Adjustment after differences in production costs

This approach estimates the difference in quality between the old product and the replacement product based on the difference in production costs. This is in line with PPI manual recommendations on an output price index. The data provider often knows the production costs. The method is based on two assumptions; that there are constant returns to scale and that it is possible for the data provider to separate the costs of the product in question. For some measurements in Industrial services, these assumptions can be considered fulfilled, since the production cost is often mostly working hours and constant returns to sale (=1) are not uncommon.

5.4 Imputation

There is sometimes temporary non-response in individual measurements and the price must then be imputed. If the non-response is permanent, a replacement product must be selected and quality adjustments must be made (see previous chapter).

5.4.1 Carry forward

It means that the price is left unchanged compared to the previous quarter. It gives the index a stability that perhaps is not proportionate to reality and the method is therefore not recommended by Eurostat unless there are strong reasons to suggest the price really is unchanged. The method is particularly poor if the product continues to be missing for several measurement periods.

5.4.2 Mean imputation

Here, price changes are used on other products in the index to estimate the price movement of the missing product. The procedure is based in the assumption that prices move in the same way within the index. This assumption might not be correct if the products are at different stages of their lifecycle.

5.4.3 Target mean imputation

One alternative to imputation with average total mean value is to select some part of the total index that can be expected to better represent the price movement of the missing product. This is called target mean imputation. The mean value can be calculated by type of service, industry, geographical region or what otherwise can best be expected to reflect the price trend of the missing product. It requires a sufficiently large sample in order to determine the price movement.

6 Future survey

In the future survey, Industrial services will be handled separately during the sampling procedure, i.e. CN-numbers starting with 992, 993, 994 and 995 will function as their own stratum. This guarantees that the requested number of observations is included in the sample and it is easier to handle the group independently. Contact with companies, price collection, quality adjustment and imputation will be taken care of by personell at PPI. When the prices have been collected, each service will be connected to the right SNI group and aggregated together into a total PPI.

6.1 Export of industrial services

Industrial services are certainly exported but the problem is how to capture these transactions. This problem also extends beyond price statistics and how Turnover statistics and Foreign trade deal with this should be investigated. A project on the Export of services will be performed within SPPI during the spring of 2008. The results of this project should be monitored.

6.2 Widening of the sample

It is possible that the sample may gradually need to be extended. Variance estimates should in the long term provide a better basis for making decisions about suitable sample sizes. An increased burden on data-providing companies and on Statistics Sweden must in such cases also be considered.

6.3 Quarterly surveys

When price measurement methods and collection methods are well established among both data providers and statisticians, it may be possible to increase the frequency of the survey to once a month. Price volatility and the burden of work on the respondents should be considered when making a decision.

6.4 Preparations prior to SNI 2008

The new industry classification will be implemented in 2008/2009. How this will affect Industrial services must be monitored, something which has also been pointed out by the national statistics offices in France and Finland. These countries have already started changing over and can be consulted if necessary.

6.5 Continued contact with the industry

When new samples are drawn and new companies included in the survey, visits to companies are recommended as far as resources allow. These visits have been very useful in explaining the aim of the survey face-to-face and difference between this and explaining things by letter is considerable. It is advantageous to develop the most suitable price measurement methods for each individual company in face-to-face dialogue. Finally, it is also important to give Statistics Sweden a face and build up confidence in the survey. Companies should be made aware of the importance of the statistics they are helping to compile and the effort they put in is reflected by the benefit of the end-product to society.

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