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Stig Erik Holiløkk

Price index for advertising activities

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Preface

Statistics Norway has developed a Service Producer Price Index (SPPI) for Advertising Services (NACE REV.2: 73.1). This document provides information on our progress in developing a final price index and current plans for how it will be executed in the years to come.

The service sector of the economy has grown considerably in recent decades and there is a manifest need to develop new statistics within this area. The European Council Regulation concerning short-term statistics covers quarterly producer prices for services. The regulation is based on the NACE classification. A broader effort to develop service producer price indices is being carried out in Statistics Norway. The aim of this project is to develop new price indices and to improve the quality of the existing indices, and the development of a price index for advertising services is a part of this effort.

The service price index is a producer price index and will serve several purposes. Its main purpose is within the Norwegian national accounts system, where it is used for calculating fixed prices for the production of services. The index is also used for planning and management, both at a political level and within economics.

Throughout this report we will use the term Service Producer Price Index (SPPI). The joint OECD-Eurostat Task Force on output prices for services clarified the use of this term in their *Methodological guide for developing producer price indices for services* (OECD/Eurostat, 2005).

In order to establish a price index we need knowledge about the sector in question. We therefore need to obtain information about the structure of the sector (size and geographic concentration), the size of enterprises, turnover and the number of enterprises, among other things. One of the key aspects we have to understand when making an SPPI, is how the mechanisms of price setting work. Typical products need to be identified in a way that enables us to make a good decision about what information we need. This is essential if we want to develop a good SPPI.

Abstract

Developing a price index for NACE Rev.2 73.1 Advertising services is part of a broader project in Statistics Norway that focuses on price statistics. The development of a price index for advertising services started in 2008.

We have studied the experiences of other countries that have already established an SPPI for advertising services. Based on these experiences, our meeting and correspondence with the Association for Creative, Commercial Communication and of course our own studies of the market in Norway, we have developed a method.

For this industry we had to develop separate methods for NACE Rev.2 73.110 - Advertising agencies and 73.120 – Media representation. Briefly summarised, this means collecting hourly charge-out rates for NACE Rev.2 73.110 and direct use of prices of repeated services for NACE Rev.2 73.120. Both of these methods are characterised as B methods, and are therefore approved and acceptable methods (OECD-Eurostat 2005 Methodological Guide for Developing Producer Price Indices for Services). The Methodological Guide classifies A methods as the most appropriate methods. B methods are, as mentioned, acceptable methods that can be used in cases where an A method cannot be applied, and furthermore, C methods are methods that are not to be used. We started collecting data from the 1st quarter of 2008.

For the sampling design, we have used Statistics Norway's business register. In accordance with Statistic Norway's own principles, we have chosen to place most of the burden on large businesses. Overall, our sample accounted for over 52 per cent of the total turnover in the population of NACE Rev.2. 73.110 and about 40 per cent for NACE Rev.2. 73.120.

The weights were gathered in the 3rd quarter of 2008 for NACE Rev.2 73.110, and will be updated every two years using information collected directly from the companies. In these periods, the index will also be chained, and the base period will be regenerated. For NACE Rev.2 73.120, we will use weights collected from Statistics Norway's structural business statistics. These will also be updated every two years.

The results from 2008 to 2011 indicate that the total index follows a development with a continuous increase. The index is shown in table 9.1 and an illustration is given in figure 9.1. From the 1st quarter of 2008 to the 1st quarter of 2011, the index for advertising services shows a growth of almost 12 per cent.

Contents

1. International experience

According to *OECD - Eurostat 2005 Inquiry on National Collection of Services Producer Prices* (OECD, 2005), some countries have developed an SPPI for advertising services. *Methodological guide for developing producer price indices for services* (OECD/Eurostat, 2005) also briefly describes how Korea, Finland, Mexico, Australia, New Zealand, France, the UK and the USA developed their price index for NACE Rev.2 73.1. This industry class has also been applied by the Voorburg Group. In Orebro in 2001, Nantes in 2002 and Aguascalientes in 2008, the UK, France, Austria and the Czech Republic all submitted mini papers and gave presentations of their experiences. In Oslo in 2009, the UK and the Czech Republic presented a continued sector paper from 2008.

Methodological guide for developing producer price indices for services (OECD/Eurostat, 2005) specifies that advertising services consist primarily of two separate activities; creation and placement of advertising. Between these two activities, several pricing methods have been used. The most accepted pricing methodology for both creation and placement of advertising is model pricing.

However, as was shown in the mini papers mentioned above, various methods and solutions are practiced around the world concerning this industry. In connection with the 24th Voorburg Group Meeting on Service Statistics in 2009, several countries presented their experiences with the advertising industry. For the creative part of the industry (NACE Rev2. 73.110), a concurrent practice of using price methods based on working time appears to exist. However, the different countries operationalise this method in different ways. For example, France, the Netherlands, Finland and Norway collect charge-out rates divided into degree of qualification or grade in the agency. Ireland also collects charge-out rates on the basis of qualification or employee category, but unlike the aforementioned countries it bases the rates on a 100-hour work contract, and then divides the amounts into percentages for the different employees involved.

For NACE Rev2. 73.120, we can see from several mini papers produced in connection with the 17th Voorburg Group Meeting in 2002 that the most common understanding is to base the measure on some sort of average prices of transactions per quarter. Some define their method as unit value, and some characterise it as direct use of prices on repeated services. Regardless of the method definition, the whole idea is to make sure that the sample services are segmented at a detailed level. This will ensure to a greater extent that the same service is measured every quarter, which is a premise when developing price indices.

The US Bureau of Labor Statistics collects transaction prices for a model, which includes the total revenue amount billed for labour (labour rates multiplied by number of hours worked by each individual involved in the project) plus any additional non-labour fees charged (Berger, Richardson & Sulc, 2008). The US BSL is still the only agency to confirm the use of model prices, although the Netherlands indicate that they wish to adopt this approach since “realised charge-out rates do not work because there is almost no relation between hours and revenues” (Berger, Richardson & Sulc, 2008).

From the *Methodological guide for developing producer price indices for services* (OECD/Eurostat, 2005), we know that Korea, Finland and Mexico use list prices or rates per hour.

2. Industry structure

In the early phase of developing this index, Statistics Norway identified a branch organisation called the Association for Creative, Commercial Communication (known as Kreativt Forum in Norwegian). In 2003, the two former organisations Norwegian Association of Advertising Agencies and Creative Forum merged their operations to strengthen the Norwegian agencies` creative focus, and subsequently formed Kreativt Forum. This organisation is affiliated to NRF (Nordic Advertising Agencies Associations) and EACA (European Association of Communication Agencies). Kreativt Forum is also a member of ICC (International Chamber of Commerce). The organisation is influential within its industry, which its vision clearly reflects: "create the world's leading environment for creative, commercial communication". Kreativt Forum's board consists of representatives from the leading Norwegian agencies, and all of the 30 largest advertising agencies in Norway are members of this organisation. We held a meeting with Kreativt Forum early in the development process, with the aim of acquiring valuable knowledge about the industry. Additionally, we had a meeting with a large media agency, and extended telephone and e-mail contact with several companies within both NACE Rev.2 73.110 and 73.120.

2.1. Population structure

According to our structural business statistics from 2009, the number of establishments, employees and turnover in the industry are distributed as follows:

Table 2.1. Population structure, Advertising agencies, Norway 2009

Size by number of employees	Number of establishments	%	Number of employees	%	Turnover (NOK mill.)	%
0	1 268	57.7	0	0,0	637.8	9.2
1-	645	29.4	1 176	25.3	1 557.3	22.4
5-9	167	7.6	1 099	23.6	1 398.0	20.1
10-19	78	3.6	1 049	22.6	1 244.5	17.9
20-49	34	1.6	1 014	21.8	1 517.1	21.8
50+	4	0.2	310	6.7	598.5	8.6
Total	2 196	100	4 648	100	6 953.2	100

We can see from table 2.1 that over 50 per cent of the advertising agencies are so-called one-man businesses. Industry concentration ratios indicate that large firms do not dominate in the industry of advertising agencies; the advertising agencies sector is instead made up of many small firms. Additionally, we can see that only 4 establishments have more than 50 employees. In spite of the fact that half of the population consists of one-man businesses, this strata only accounts for 9 per cent of the total turnover in the industry. The table also tells us that the number of employees and share of total turnover are evenly spread between establishments with more than one employee.

Table 2.2. Population structure, Media representation, Norway 2009

Size by number of employees	Number of establishments	%	Number of employees	%	Turnover (NOK mill.)	%
0	119	49.2	0	0,0	127.1	1.3
1-4	72	29.8	124	9.1	398.7	4.0
5-9	13	5.4	84	6.2	273.3	2.8
10-19	16	6.6	219	16.1	1 049.9	10.6
20-49	15	6.2	440	32.4	2 489.3	25.2
50+	7	2.9	490	36.2	5 556.6	56.2
Total	242	100	1 357	100	9 894.9	100

Table 2.2 shows the industry structure for the establishments within media representation. We can see that this structure is the complete opposite of the structure for advertising agencies. Here we are looking at slightly less than 250 establishments, where those with more than 20 employees account for over 80 per

cent of the turnover in the industry. The 22 establishments with more than 20 employees also account for almost 70 per cent of the total number of employees in the industry.

Table 2.3. Turnover within industry class and subclass divided by CPA/type of service, NACE 73.1. CPA study 2009

Products and residency by client	Turnover NOK million	Turnover Percentage distribution
Products, total	16 468.5	100.0
1. Media representation services	10 165.2	61.7
1.1 In print media	3 627.8	22.0
1.2 In TV/radio	3 027.6	18.4
1.3 In Internet	1 359.8	8.3
1.4 Sale of events relating to advertising	65.0	0.4
1.5 Other medias	2 085.0	12.7
2. Services by advertising agencies	5 796.6	35.2
2.1 Full service advertising	2 834.6	17.2
2.2 Direct marketing	423.3	2.6
2.3 Advertising design	1 499.2	9.1
2.4 Other advertising services	1 039.5	6.3
3. Other additional products	506.7	3.1

Table 2.3 shows the turnover distribution between different fields of activities as they appeared in Statistics Norway's 2009 CPA survey. CPA is the European Union standard for products grouped according to main activity[1].

2.2. Sample design

The sample design uses Statistics Norway's business register as a basis. The population consists of all establishments registered as NACE Rev 2. 73.110 and 73.120 in Statistics Norway's business register.

In accordance with Statistics Norway's principles, we will place most of the burden on the large establishments, in that a higher percentage of the large establishments will be included in the sample. In addition to the fact that they have greater resources for undertaking such tasks, we will also obtain sufficient coverage of the turnover in the industry by using a limited number of respondents, since the large establishments represent a substantial share of the total.

Table 2.4. Sample design for NACE Rev2. 73.110

Employee groups	Probability of inclusion in the sample (in per cent)	No. of establishments	Coverage rate (of total turnover)
0	0	0	0.0
1-4	3	32	0.7
5-9	13	19	2.3
10-19	60	50	8.3
20-49	100	24	14.2
+50	100	7	26.6
Total		132	52.1

As you can see from table 2.4, we are including all of the establishments with more than 20 employees in NACE Rev.2 73.110. The probability of being included is proportional to size, where size is measured in number of employees. Over 50 per cent of the turnover in the industry is covered using this design.

[1] CPA is short for Statistical Classification of Products by Activity in The European Community

Table 2.5. Sample design for NACE Rev2. 73.120

Employee groups	Probability of inclusion in the sample (in per cent)	No. of establishments	Coverage rate (of total turnover)
0	0	0	0.0
1-4	70	87	12.6
5-9	100	21	12.4
10-19	100	8	29.8
20-49	100	10	19.4
+50	100	3	18.5
Total		129	92.6[2]

Table 2.5 shows us that the industries of NACE Rev.2. 73.120 have considerably fewer establishments than 73.110, and on the basis of the complexity of the industry we had to draw a relatively large sample. This led to the decision that every establishment with more than 5 employees would be included in the sample.

The sample was drawn in the 3rd quarter of 2008. We use structural business statistics to determine the criteria for the sample. In 2008, the latest version of the structural business statistics was 2006. There are therefore some discrepancies between the numbers of establishments in the tables in chapter 2.1 and the tables in this chapter .

3. Pricing methodology

According to our structural business statistics, this industry has experienced an increasing trend in the last six years. From 2002 to 2008, the total turnover in the industry increased by more than 47 per cent. As discussed in the chapter on international experiences, NACE Rev.2. 73.1 can be divided into creation and placement of advertising, hence NACE Rev.2. 73.110 and 73.120. These are two distinct industries and will, in our index, be treated differently. In creation, we often find advertising agencies, and in placement we will typically find media agencies and media marketers (sales houses).

Our meeting with Kreativt Forum produced a great deal of useful information. On the basis of information from the trade organisation we found that it would be reasonable to collect hourly charge-out rates for different employment categories, for NACE Rev.2 73.110. They have themselves used this method when conducting price surveys among their members. The agencies bill their customers on the basis of invoiced hours and hourly rates. It is also the case that different employee categories have different hourly rates and different numbers of hours worked. Some categories generate more working hours and some categories find themselves at higher price levels. It would therefore be natural to adjust for these price settings in the calculation of the index and the weights. By doing this for employee categorisation, we will to some extent adjust for educational standards and experience in the industry. The employment categories that are used in the different companies will vary, but Kreativt Forum was adamant about a couple of categories that we could find in every company; art director, text writer, project leader, planner and consultant. Within smaller companies the same person will cover several of these categories.

For NACE Rev.2 73.120, we found that we have to collect price information from clearly specified services. Advertising space can be sold in many different media, such as television, radio, newspapers, magazines, Internet, billboards, cinemas etc. One of the major challenges is to ensure that we are measuring price changes in representative advertising services. We will therefore use a price method that can be viewed as direct use of prices of repeated services. This cannot directly be regarded as contract pricing since it is not based on a single transaction, but rather

[2] When we drew the sample in 2008 the structure of the population was quite different. Today's coverage of this NACE is about 40 per cent.

multiple transactions – for instance, the price for a 4x2 metre billboard at the central station in Oslo. Each of the different media contains multiple price determining characteristics. To ensure that these characteristics are taken into account, we ask the respondents to specify the ad placement services at a highly detailed level. As mentioned above, it is important that the index reflects advertising placements that can be regarded as representative. This is an industry that develops rapidly, not just in accordance with the kind of media that are popular, but also the type of characteristics within the different media that are the most significant due to the price setting. In order to ensure that we have the most representative products included in our index, we urge the companies to change their reported products at regular intervals.

3.1. Questionnaires

With two distinct industries with distinct pricing methodologies it was obvious that we had to develop two sets of questionnaires; one for creation of advertising and another for placement of advertising. After the meeting with Kreativt Forum and several conversations with different companies in the two industries, we developed two questionnaires that we planned to test in a pilot study (you will find copies of the questionnaires in the appendix).

For 73.110, we continued pursuing the idea of collecting hourly charge-out rates for different employee categories:

- Creative leader
- Art director
- Text writer
- Consultant
- Planner
- Project leader
- Ad assistant/Mac
- Web programmer
- Web designer

We drew a sample of 50 establishments for the pilot study for NACE Rev.2 73.110, and about 60 per cent provided feedback on the questionnaire. The results from the pilot study told us that the majority of the companies had no problems with answering the questionnaire. Some of the companies did not bill their customers on the basis of hourly charge-out rates, but on the basis of constant product prices. These companies were asked to break down the charge-out bill by hours spent on the work. The pilot study also showed that some of the employment categories were priced at the same level. The art director and consultant were typically priced at a higher level than the project leader and ad assistant. If it is not possible for a company to state their hourly charge-out rates for the different employee categories they are given the opportunity to state their list prices. The results from the pilot study were of such good quality that no significant changes were made in the final questionnaire.

The questionnaire for NACE Rev.2 73.120 media representation services was, as mentioned above, based on the method of repeated services. The first time we sent the questionnaire to these establishments we asked them to describe three representative advertising services/products sold by the company. Additionally, they should state prices for the different services, and which unit the prices were stated in.

Finally, they should state the number of units that the customers receive for the stated prices. An example is as follows:

Product description/name			Product/project number
Outdoor 2100			7410
Period	**Price excl. VAT in NOK**	**Unit of price**	**Number of units**
1st quarter 2008	800 000	Per week	750
2nd quarter 2008	815 000		750

The second time we sent the questionnaire, the services/products that the establishments stated previously were pre-entered in the questionnaire. All they had to do was to state prices for the same services within the current period. If the services they stated previously are no longer representative, they should replace the service with another. They were also asked to state the price for the new service for the previous quarter. We drew a sample of 50 establishments for the pilot study. Since the pilot study was voluntary, we only achieved a 40 per cent response rate. The results gave us an indication that the companies would be capable of filling out the questionnaire. Some of the companies required a little guidance with regard to what type of services we wanted and what we meant by unit of price and number of units. This feedback resulted in the development of a guidance sheet, which we enclosed with the questionnaire.

3.2. Quality adjustments

The intangible nature of services such as advertising services makes it harder to produce reliable price indices. Direct quality adjustments are difficult to implement satisfactorily, and it would also represent a considerable burden on the respondents.

For NACE Rev.2 73.110 Advertising agencies, this is especially difficult due to the fact that we are using hourly charge-out rates to measure the price development. This means that for advertising agencies we are not taking into account any changes in the level of productivity. The scope of the problem is currently unknown. One of the main quality adjustment challenges regarding this industry is to separate the effects of the advert itself from the effects of the product attributes that are being advertised. Let's envisage an advertisement that informs us about a 50 per cent sale on a product, and where the sales growth gets measured after the campaign. How much of the sales growth can be attributed to the price reduction, and how much can be attributed to the effect of dispersing the message through the media? Our index does not adjust for such aspects.

For NACE Rev.2 73.120 Media representation, we will have better control in relation to the issues concerning quality adjustments. If the services selected for data collection are well defined we should be able to eliminate a large part of the quality issues. It is important to define all the factors that influence the pricing and try to collect the services that are most representative from that point of view. As we mentioned earlier, the establishments should replace services that are no longer representative with new ones. Additionally, we ask the establishments to state the number of units for each service. Changes in this variable will also act as an indicator of quality change.

3.3. Weights

For NACE Rev.2 73.110 Advertising agencies, weights will be carried out for the number of hours worked between the different employee categories. We asked the respondents in the first questionnaire to state, in addition to the prices, the number of hours worked in the last year broken down into the different employee categories. The weights are also based on relative size of the establishments. Size is measured in number of employees, and the establishments are divided into three stratums:

Stratum 1 → 0-4 employees
Stratum 2 → 5-19 employees
Stratum 3 → + 20 employees
Information on numbers of employees is collected from Statistics Norway's business register.

With regard to NACE Rev.2 73.120 Media representation, a weight will be calculated for each establishment based on its turnover divided by the total turnover in the sample. Information about their turnover will be gathered every two years through the structural business statistics. This means that all of the three services/products within the same establishment will be given the same weight.

3.4. Data collection

The respondents receive the questionnaire a couple of days before the end of the quarter. The deadline for reporting is normally three weeks (there is a longer deadline after the 2nd quarter to allow for summer holidays). The firms can either answer the questionnaire using the paper version or via IDUN (Statistics Norway's system for the electronic exchange of data with business enterprises). If Statistics Norway has not received the questionnaire by the deadline, a reminder with a warning of a compulsory fine will be sent out. A new deadline of 1 week is then set. If the questionnaire is still not returned, a decision to impose a compulsory fine is made. The respondent is then informed by letter that they have one final week to send in the questionnaire before the decision is made final. Because of Statistics Norway's ability to impose disclosure requirements and our online reporting facility, we have a response rate of close to 100 per cent. All the data we collect is transferred to ISEE (Integrated System for Editing and Estimation). In ISEE we are able to audit the data and calculate the indices.

4. Mathematical formulation

This section explains the mathematical formulation of the index calculation for the SPPI for NACE rev.2 73.1. Statistics Norway has developed an application for data revision and price index calculation. This application is intended for use for all SPPIs that Statistics Norway is planning to develop over the next few years and the SPPI that Statistics Norway has already developed. This application will ensure a thorough and efficient data revision and price index calculation. The description of the steps in the index calculation was developed by Zhang (2006) and will be in accordance with this general application.

Notation

- Weight basis period (b)
- Price basis period (s)
- Statistical/actual period (t)
- Index reference period (r)
- Price observation (p)
- Index (P)

4.1. Price relative and elementary index

Denote service j in elementary group i with (ij), for j = 1,..,ni. p_{ij}^{t} is the price for (ij) at the statistical/actual period t, and p_{ij}^{s} the price in the base period. An example of an elementary group for this SPPI is: art director (employee category) — size band 0-4 (stratum). This elementary group consists of all price relatives

from the employee category of art directors, in stratum 1, within NACE 73.110.

Furthermore, let

$$I_{ij}^{s,t} = \frac{p_{ij}^{t}}{p_{ij}^{s}}$$

be a price relative. $P_i^{s,t}$ is the i elementary index[3], also known as micro index. An elementary index is calculated without the use of weights. This is the first step of the calculation, and we will use a Jevons index, which we calculate as follows:

- Jevons index (geometric average)

$$P_i^{s.t} = \left(\prod_{j=1}^{n_i} \frac{p_{ij}^{t}}{p_{ij}^{s}} \right)^{\frac{1}{n_i}} = \exp\left\{ \frac{1}{n_i} \sum_{j=1}^{n_i} \log p_{ij}^{t} - \frac{1}{n_i} \sum_{j=1}^{n_i} \log p_{ij}^{s} \right\}$$

We have decided to use the Jevons index and calculate a geometric average. This applies to both 73.110 Advertising agencies and 73.120 Media representation. We examined the strengths and weaknesses of the different indices (Carli, Dutot and Jevons) using the theory from the Producer Price Index Manual (IMF, 2004). Table 9.1 in the PPI Manual (IMF, 2004) shows us that the choice of elementary index can make a substantial difference to the results obtained. First, it is well known that an arithmetic mean or average (Carli index) is always[4] greater than the geometric average (Jevons index). The Dutot index may be greater or less than the Jevons, but tends to be less than the Carli index. The PPI Manual also states that the differences between the results obtained by using the different elementary indices tend to increase as the variance of the price relatives increases.

A weakness with the Carli elementary index is that it is not transitive. The example in the PPI Manual shows that the chained Carli index that has the same prices for all products in the base period and the actual period does not give the same index value in the two periods. We are chaining the indices for this SPPI so this may be a reason to prefer the Dutot or the Jevons elementary index.

The PPI Manual (chapter 9) recommends the use of Jevons from an axiomatic point of view. Furthermore, services with high prices will implicitly get a higher weight with the use of Dutot. This means that price changes in advertising placements with high prices will influence the Dutot index more than price changes in services with lower prices. By the very fact that the level of prices in these kinds of services will vary considerably, our choice landed on Jevons.

4.2. Calculation of weights

We aggregate the elementary indices up to a "total" SPPI for each of the two industries with the use of weights, w_i^b for elementary group i in the weight basis period b. We have that:

$$w_i^b \rangle 0 \qquad \text{and} \quad \sum_{i=1}^{M} w_i^b = 1$$

In addition to calculating the "total" SPPI for the two industries we will also calculate some sub-indices for 73.110 – employee categories. To calculate

[3] The elementary indices are actually an estimate for an unknown parameter called the theoretic elementary index.

[4] Only in the odd case where all of the price relatives are equal will the arithmetic average be equal to the geometric average.

elementary indices up to a sub-index at aggregation level G, we need the weight $w^b_{i(G)}$ for i ε G.

Sub-index weights are calculated as follows:

$$w^b_{i(G)} = \frac{w^b_i}{\sum_{k \varepsilon G} w^b_k}$$

4.3. Index calculation

For NACE Rev.2 73.110 Advertising agencies, we will calculate an L-type index:

$$P^{s,t}(b) = \sum_i w^b_i P^{s,t}_i$$

$P^{s,t}(b)$ becomes a true Laspeyres index if b = s and $P^{s,t}_i = I^{s,t}_i = \frac{p^t_i}{p^s_i}$, and we will calculate the SPPI as follows:

$$P^{s.t}(s) = \sum_i \frac{q^s_i p^s_i}{\sum_k q^s_k p^s_k}\left(\frac{p^t_i}{p^s_i}\right) = \frac{\sum_i q^s_i p^t_i}{\sum_i q^s_i p^s_i}$$

Normally, a Laspeyres index will overestimate the index, while a Paasche index will underestimate it. The Fisher index will land somewhere in the middle of the two.

For NACE Rev.2 73.120 Media representation, the price basis period will always be the previous quarter for the statistical/actual period. This means that when we are using the current price basis period we must chain the index from period to period. Consequently, it is hard to define the index as a Laspeyres or a Paasche index. With a Laspeyres index it is common to use the values in the price basis period as weights, and in a Paasche index it is common to use values in the statistical period as weights. In this index we have annual weights that we collect from our structural business statistics. Taking this into account, the index is more similar to a Young index, since we use annual weights. On the other hand, our index breaks with this type of aggregated index because we change the price basis period every quarter. The focus should therefore not be whether this is a Laspeyres, Paasche or Young index, but rather that this will be a chained index. The chained elementary index will be calculated as follows:

$$\widetilde{P}^t_i = P^{s,s'}_i P^{s',t}_i$$

In the last step of calculating the index for NACE Rev.2 73.120 we also need to chain the total index.

We will in this case get two different variants. We will only use the first one when we are changing the price basis period:

$$\widetilde{P}^t_G(b) = \widetilde{P}^{t-1}_G(b) P^{t-1,t}_G(b)$$

The latter one will be used when we are changing both the price basis period and the weight basis period. In our case, we will use the latter variant once a year:

$$\widetilde{P}_G^t(b) = \widetilde{P}_G^{t-1}(b) P_G^{t-1,t}(b')$$

The SPPIs for advertising agencies and media representation will together form the total index of advertising services. When creating the total index, the two sub-indices will be weighted according to total turnover in the industry.

5. Documentation of the statistical procedures

To ensure that the data we collect from the respondents are reliable and represent a realistic picture of the industry, quality assurance is necessary. Every questionnaire is closely examined and edited if necessary. This process requires both judgement and knowledge about the index. The examination is done manually, with the aid of electronic auditing applications.

The review comprises, essentially, two methods: micro-based and macro-based. The first of these assesses each piece of information received from the respondents. For this, a data editing application called Dynarev is used, which allows controls to be defined that mark a data field with "error" if the item of information does not meet the specified criteria. This functions only as an alarm; the actual editing has to be performed manually. There are three particular types of controls that we employ with each item of price information:

- Value compared with previous period. The control raises the alarm when there is a large change in price compared with the previous quarter. A large change might indicate a discontinuity.
- Value compared with the same quarter previous year. The control raises the alarm if the price is lower than it was in the corresponding quarter of the previous year. Normally we expect prices to increase. However, there have been cases where verified price decreases occur. These are confirmed by contacting the respondent.
- Continuity. The control raises the alarm if the value has remained unchanged for five quarters. A source of error in the index calculation that may be difficult to detect is where observations remain unchanged over a long period. This may be due to a respondent's lack of commitment to the accuracy of the survey, or it may be attributable to natural causes. In these cases we usually contact the respondent, either by phone or e-mail. It is not unusual for a company to have unchanged prices over several periods, especially in the case of smaller companies located outside the major cities. It may at some stage be appropriate to extend the number of periods of unchanged prices needed to trigger the alarm.

In the macro review, we control which price observations have the strongest effect on the calculated indices. We use Rstudent and DFFITS to rank the most diverging and decisive values. We also have to make assessments as to whether the observations are actually problematic.

Table 5.1. Screen print of Rstudent controls. NACE rev2. 73.110

Weight	Basis price	ORGNR	Price this quarter	EI-group	Studentized Residual without Current Obs	ref_rstudent
0,092283	1250	971XXXXXX	1450	2;2	3,78793	2
0,092283	1300	981XXXXXX	1100	2;2	-3,38933	2
0,088005	400	987XXXXXX	600	7;1	3,64927	2
0,063832	800	976XXXXXX	600	6;2	-3,46359	2
0,057542	1130	975XXXXXX	1240	2;3	2,12659	2
0,057542	1260	991XXXXXX	1420	2;3	3,05285	2
0,035142	1130	975XXXXXX	1240	3;3	2,12659	2
0,032502	1000	976XXXXXX	800	8;2	-3,43368	2
0,032502	1380	980XXXXXX	1190	8;2	-3,19395	2
0,032502	1300	981XXXXXX	1100	8;2	-3,38933	2

Rstudent is a standardised residual (with constant variance) by regression of the present price over the basis price. An example of an Rstudent control is shown above. “Orgnr” tells us which company the observation comes from. Weight gives us an indication of how significant the observation is in relation to the calculated index. Only Rstudent values greater than +/-2 are shown in this table. In the example above, we have no price observations with an Rstudent value of greater than 4. None of these observations are likely to be investigated further.

DFFITS is a diagnostic meant to show how influential a point is in a statistical regression. In other words, it is a method we use to intercept price relatives that have a strong influence on the index calculation.

6. Results

6.1. Index results

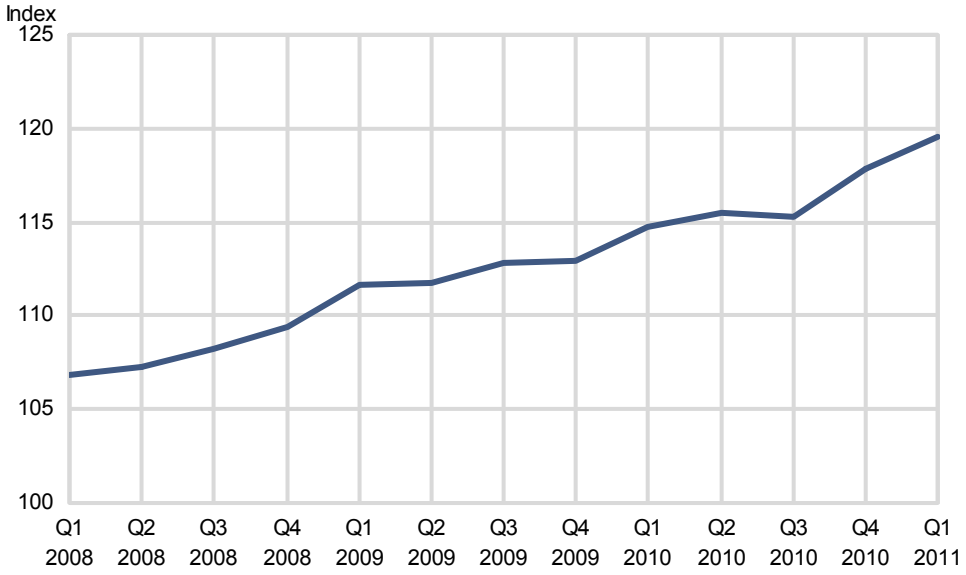
Table 6.1 shows the development of the price index for advertising services from the first quarter of 2008 to the first quarter of 2011. Figure 6.1 gives a graphic description of this development.

Table 6.1. Price index for advertising services. Q1 2008-Q1 2011

	Price index for advertising services. 2006=100
1st quarter 2008	106.9
2nd quarter 2008	107.3
3rd quarter 2008	108.2
4th quarter 2008	109.4
1st quarter 2009	111.7
2nd quarter 2009	111.8
3rd quarter 2009	112.9
4th quarter 2009	113.0
1st quarter 2010	114.8
2nd quarter 2010	115.5
3rd quarter 2010	115.2
4th quarter 2010	117.9
1st quarter 2011	119.6

We can see that there was continuous growth through 2008. In 2009 the increase becomes smaller, before taking a new leap in the 1st quarter of 2010. The modest growth in 2009 may be correlated with the financial crisis that year. From the 1st quarter of 2008 to the 1st quarter of 2009 the increase was 4.5 per cent. In comparison, the growth was 2.8 per cent from the 1st quarter of 2009 to the 1st quarter of 2010, and 4.2 per cent from the 1st quarter of 2010 to the 1st quarter of 2011.

Figure 6.1. Price index for advertising services. Q1 2008-Q1 2011.



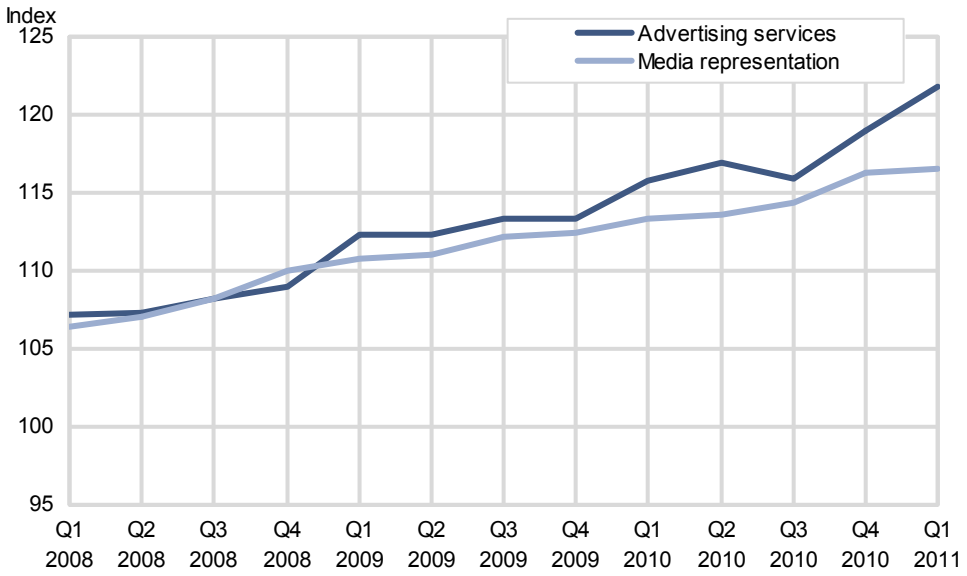
The above graph also illustrates that the price index takes a leap at the beginning of a new year. This is probably due to the fact that many companies adjust their prices in the 1st quarter. In table 6.2 we present the two sub-indices that create the total index of advertising services, namely the sub-indices for advertising agencies and media representation.

Table 6.2. Sub-indices for advertising agencies and media representation. Q1 2008-Q1 2011

Period 2006=100	73.110–Advertising agencies	73.120–Media representation
1st quarter 2008	106.4	107.2
2nd quarter 2008	107.1	107.4
3rd quarter 2008	108.2	108.2
4th quarter 2008	110.0	109.0
1st quarter 2009	110.7	112.3
2nd quarter 2009	111.0	112.4
3rd quarter 2009	112.2	113.3
4th quarter 2009	112.4	113.4
1st quarter 2010	113.3	115.8
2nd quarter 2010	113.5	117.0
3rd quarter 2010	114.3	115.9
4th quarter 2010	116.3	119.0
1st quarter 2011	116.5	121.8

Table 6.2 shows that the price growth has been stronger in the industry of media representation. From the 1st quarter of 2008 to the 1st quarter of 2011 the sub-index for media representation has increased by 13.6 per cent. In comparison, the price increase for advertising agencies in the same period was 9.5 per cent. Figure 6.2 shows a graphical presentation of the sub-indices.

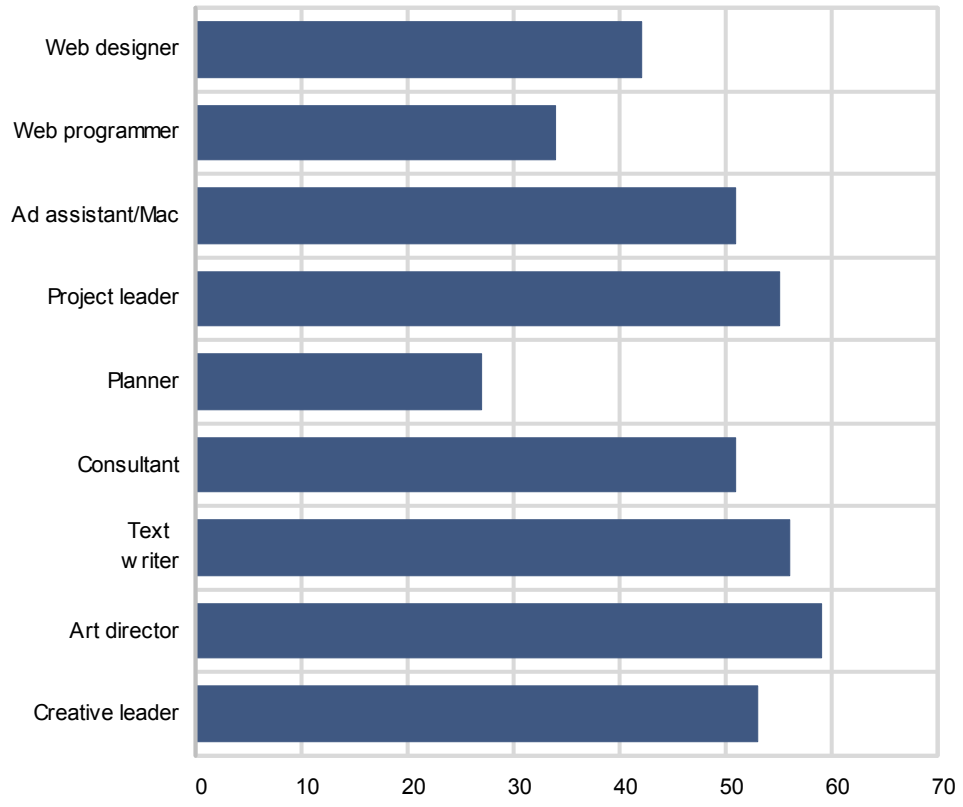
Figure 6.2. Sub-indices for advertising services. Q1 2008-Q1 2011



The figure tells us that the two sub-indices follow each other to the 4th quarter of 2008. From this point the index for media representation lies at a higher level than the index for advertising agencies. The 1st quarter of 2010 indicates that this difference is increasing.

Figure 6.3 illustrates the number of observations for the different employee categories in the sub-index for advertising agencies. In spite of the fact that this observation count is taken from only one period, it still gives a true picture of the observation structure. The number of observations lies at a stable level every quarter; between 410 and 430 price observations. We can see from the figure that the observations are distributed relatively evenly between the different employee categories, and that the number of observations is lowest for the planners. This employee category is relatively new in the Norwegian advertising industry, and the use of this title will vary from agency to agency. Our data material indicates that only the largest advertising agencies use this title.

Figure 6.3. Number of observations per employee category in advertising agencies.

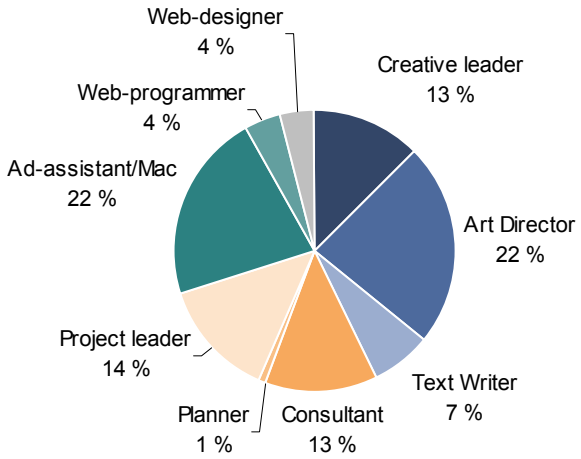


For media representation, the observation count is between 350 and 400 observations every quarter.

6.2. Distribution of weights

The weights for advertising agencies are calculated from number of hours worked. Figure 6.4 illustrates the distribution among the different employee categories. The figure shows us that the art director and his/her assistants (Ad ass/Mac) generate the most working hours. This means that these employee categories get a higher weight in the index calculation. We can also see that the planners have the least working hours. This is connected with the fact that this employee category is still new in the Norwegian advertising environment.

Figure 6.4. Distribution of weights - Employee categories in advertising agencies



To ensure that our weights were based on representative data, we cross checked our results with figures from Statistics Norway's labour force survey[5]. This test gave us affirmative conclusions regarding our weight distribution. In the labour force survey, employee categories such as art director, project leader, ad assistant and consultant were significantly more represented than the other categories. Also in this survey, the employee category of planners was placed at the bottom of the list.

For the establishments in the industry of media representation, weights are calculated based on turnover. This means that their annual turnover is divided by the total turnover for the whole sample.

When we aggregate the two sub-indices into the total index for advertising services, we use the proportion between the total turnovers in the population of these two industries.

6.3. Evaluation of uncertainty

We apply a stochastic approach to the calculation of this price index; an approach to index number theory that treats each price relative as an estimate of a common price change. The advantage of this approach is that the uncertainty is quantified, by estimation of probability distributions for the results. This uncertainty can be estimated with model variance, which is the weighted sum of variance in the elementary indices. The variance that we measure will mainly be affected by variance within single price observations, as well as the amount of price observations that are included in an elementary index.

Figures 6.5 and 6.6 describe the uncertainty by calculating the confidence interval. A confidence interval is an interval that with great probability contains the X that we wish to estimate. We operate with a 95 per cent confidence interval. This means that we can say with 95 per cent certainty that the mean of the population lies between these intervals.

[5] In the data material from the labour force survey we were able to break employment figures down to the Standard Industrial Classification and the Standard Classification of Occupations.

Figure 6.5. Index for advertising agencies with 95 per cent confidence interval

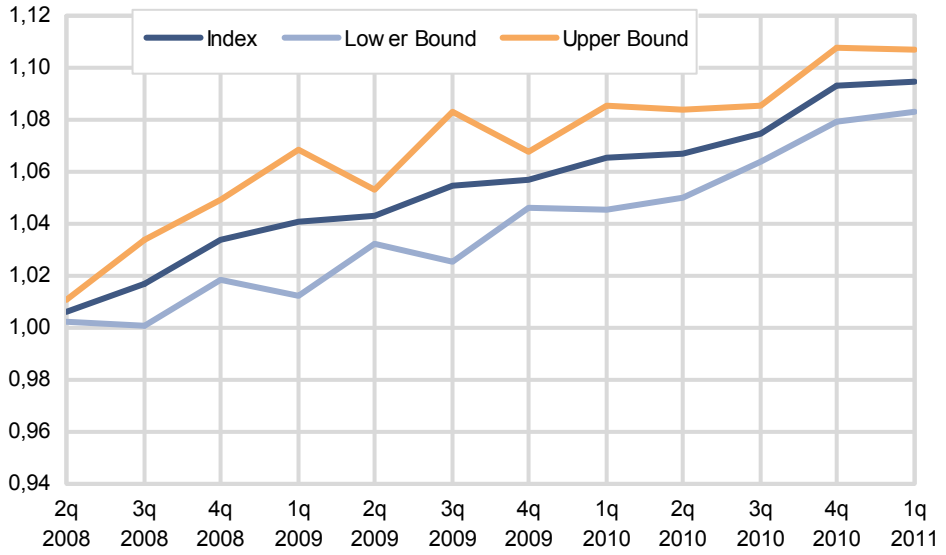
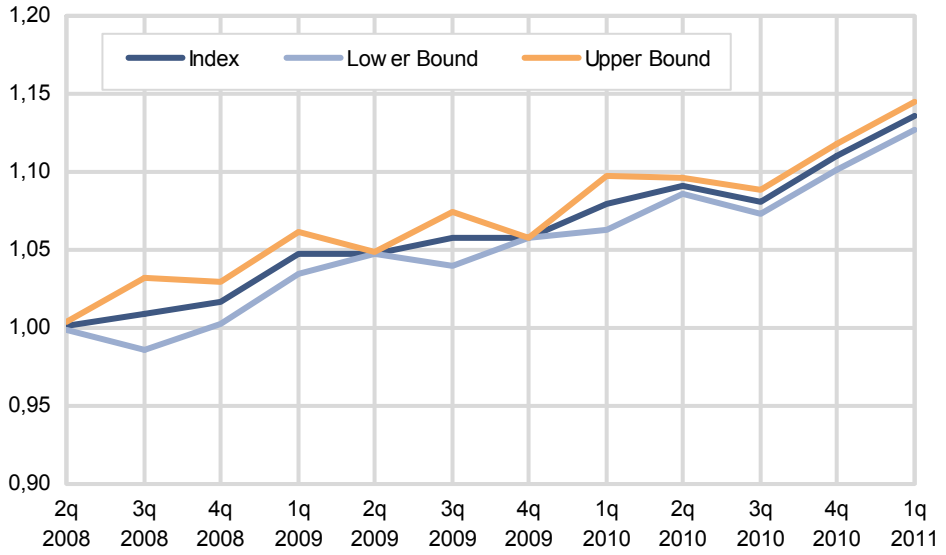


Figure 6.6. Index for media representation with 95 per cent confidence interval



We calculate the 95 per cent confidence interval by taking the index value and adding or subtracting the standard error multiplied with 2. Similar to the standard of errors, the confidence interval also indicates an increase as the time moves forward from the base period. In figure 6.5, we can see that the confidence interval increases until we reach the periods where we changed the base period. The changes of base periods were a consequence of changes in the sample structure. These periods were the 2nd and the 4th quarter of 2009. For media representation we chain the index every period, and therefore move forward the base period to the previous quarter. In figure 6.6 we can clearly see the effect that we discussed in chapter 6.1; where the companies seem to adjust their prices twice a year.

6.4. Publishing

As mentioned in the introduction to this report, the main purpose of this index is for use in the Norwegian national accounts system. To ensure topicality, we publish our indices within 45 days of the end of the quarter, or 60 days for the second quarter, when the deadline for respondents is extended due to the summer holidays.

For NACE Rev.2 73.1, we will publish the total index for the 3-digit NACE Rev.2. 73.1 – Advertising services.

From the second quarter of 2011, the price index for advertising services will be published together with other indices within sections M and N in the Standard Industrial Classification (SIC2007).

Within the last five years, the development of the Service Producer Price Index (SPPI) statistics has been a clear priority for Statistics Norway. This focus is reflected in our theme page for price indices on our website (http://www.ssb.no/priser_en/).

6.5. Estimation of data back to 2006

According to COUNCIL REGULATION (EC) No. 1165/1998 of 19 May 1998 concerning short-term statistics AMENDED by the REGULATION (EC) No. 1158/2005 of the EUROPEAN PARLIAMENT and of the COUNCIL and by COMMISSION REGULATION (EC) 1503/2006, the first reference period for transmission of the output price variable No. 310 is not later than the first quarter of 2006. Since we began our data collection in the 1st quarter of 2008 we have to estimate data dating back to 2006 in order to set the base year to 2006.

In order to avoid as much uncertainty as possible, we have used Statistics Norway's statistics on average monthly earnings within the industrial classification of advertising services (NACE Rev 1.1 74.4). Another reason for using the wage statistics was to avoid any further burden for the respondents. We took the original index (2008=100) and estimated these figures backwards by means of annual growth in monthly earnings from 2006 to 2008.

Appendix: Questionnaires

73.110 Advertising agencies

1. What is your company's primary activity?

- ☐ Our company is engaged in preparing, designing and placing advertising
- ☐ Our company is engaged in (re)sale of advertising placement
- ☐ Our company is engaged in media advising
- ☐ Our company is not engaged in any advertising activity (please specify in the commentary field)

2. Please state the total number of charge-out work hours in 200X within the job categories below.

Creative leader		hours
Art director		hours
Text writer		hours
Consultant		hours
Planner		hours
Project leader		hours
AD assistant/Mac		hours
Web programmer		hours
Web designer		hours

3. Please state average charge-out rates for the job categories below.

Calculate the charge-out rate by dividing the charge-out amount (excl. VAT) by the number of charge-out work hours.
If charge-out rates are not available, you can state standard hour rates (list prices). State only price information concerning job categories that have been charged for.

Creative leader		NOK
Art director		NOK
Text writer		NOK
Consultant		NOK
Planner		NOK
Project leader		NOK
AD assistant/Mac		NOK
Web programmer		NOK
Web designer		NOK

3. What type of price information did you state?

- ☐ Charge-out rates
- ☐ List prices

73.120 Media representation

Please enter the product description/name for three products within the placement or sale of advertising space or time.

For these products, state the price (excluding VAT), price unit, and number of units.

In the next quarter you will be asked to state the prices of the same products. It may therefore be useful to state product descriptions that you can easily interpret later. Product/project numbers can be your internal number for distinguishing your products.

Price excl. VAT: The price of the product exclusive of value added tax.
Price unit: The unit of price that the prices are stated with, e.g. "per week", "per piece" or "per click"
Number of units: If the price stated gives the customer a certain number of ads or copies of the product, this number must be stated. If the price is per piece (or the number is difficult to estimate) you can set the number to 1.

Product 1

Product description/name	Product/project number
Module 55, colour, news section in a local paper	11

Period	Price excl. VAT in NOK		Unit of price	Number of units
1st quarter 2008	9 000		per order	1
2nd quarter 2008	9 000			1

Product 2

Product description/name	Product/project number
Outdoor 2100	7410

Period	Price excl. VAT in NOK		Unit of price	Number of units
1st quarter 2008	800 000		per week	750
2nd quarter 2008	800 000			750

Product 3

Product description/name	Product/project number
Cinema advertising, national	100

Period	Price excl. VAT in NOK		Unit of price	Number of units
1st quarter 2008	54 400		30 sec-4 weeks-full distribution	1
2nd quarter 2008	56 000			1

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