

# Various data collection methods in the Norwegian CPI

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Ingvild Johansen  
Statistics Norway  
[ingvild.johansen@ssb.no](mailto:ingvild.johansen@ssb.no)

Ragnhild Nygaard  
Statistics Norway  
[ragnhild.nygaard@ssb.no](mailto:ragnhild.nygaard@ssb.no)

## Abstract

Traditionally, the prices used in the Norwegian CPI (Consumer Price Index) have mainly been collected using paper questionnaires. Today, these questionnaires are still in use, but electronic versions and other alternative methods of collecting price data, such as scanner data from head offices and other types of electronic data from secondary sources, have gradually become more common. What are the consequences of seeking alternative data sources and methods? The burden has surely been reduced on the data providers, but not necessarily on the statistical agency itself. In this paper, new alternative data collection methods and their implications are discussed.

<b>Abstract</b> .....	<b>1</b>
<b>1. Introduction</b> .....	<b>3</b>
<b>2. Paper questionnaires</b> .....	<b>3</b>
<b>3. New ways of collecting data</b> .....	<b>4</b>
3.1 Web questionnaires .....	5
3.1.1 From paper to web questionnaires – some implications.....	5
3.2 Scanner data and data from secondary sources .....	6
3.2.1 Scanner data – some implications .....	7
<b>4. More efficient resource use?</b> .....	<b>8</b>
4.1 Efficiency gains for businesses? .....	8
4.2 Efficiency gains at Statistics Norway?.....	9
4.2.1 Increase in full-time equivalents.....	9
4.2.2 More complicated CPI production?.....	9
<b>5. Conclusions</b> .....	<b>11</b>
<b>References</b> .....	<b>11</b>

# 1. Introduction

Most National Statistical Institutes (NSIs) send price collectors to local outlets to collect prices for their Consumer Price Indices (CPIs). Statistics Norway, however, has a long history of sending paper questionnaires to the data providers, where the shopkeepers themselves complete the questionnaires and return them by post. Paper questionnaires have been the dominant data source in the Norwegian CPI for many years, and most of the prices have been collected in this way. Still today, Statistics Norway collects prices by means of paper questionnaires, but electronic versions and other alternative methods of collecting price data have gradually become more common in the CPI.

Statistics Norway's overall strategy, often shared with other NSIs, is to collect data effectively with reduced costs and with the lowest possible response burden. An overall goal has been to introduce technologies that reduce the number of paper questionnaires, with the aim of a more efficient data collection process both for data providers and the statistical agency.

Reducing the response burden and the inconvenience of providing data is not just important from a social and political point of view. Like other NSIs, Statistics Norway also has ongoing efforts to improve data collection methods from a data quality perspective. A high response burden may have a negative effect on the quality of the data received - businesses may respond to the high response burden by sending less accurate data or not filling in the questionnaire at all. Lack of motivation to give timely and accurate responses may also result in high costs due to resource-demanding data editing processes.

Consumers' purchasing behaviour is gradually changing, simultaneous to the pricing of goods and services becoming more complex and dynamic. The importance of the Internet as a channel to purchase consumer goods and services is continuously growing and Internet technology has increased the availability of prices and product information. It is crucial that the NSIs monitor and adapt their data collection methods accordingly. More and more data is now being collected directly from head offices' own data systems, or from alternative secondary sources. Access to electronically registered data and different databases may provide the NSIs with much larger amounts of data than before and with new possibilities but also challenges for calculating price indices.

What are the consequences of seeking alternative data sources and collecting data through a variety of channels? Are the new ways of collecting data more efficient, with less resource needed both from the respondents and recipients' perspective? In this paper, these questions will be discussed based on the Norwegian CPI data collection experience. In chapter 2, the use of paper questionnaires is outlined. In chapter 3, new data collection methods are presented. The focus is on the use of web questionnaires, scanner data as well as data from secondary sources. In chapter 4, the use of resources is considered. Some concluding remarks are given in chapter 5.

## 2. Paper questionnaires

The traditional data collection method chosen for the CPI in Statistics Norway is different from many other statistical agencies. Statistics Norway has for a long time used paper questionnaires as the main source for collecting prices for the CPI. Since the beginning of the 1990s, new questionnaires have been produced every month at Statistics Norway and sent by post<sup>1</sup>. Information about prices and product descriptions from the outlets from the last two months are pre-printed on the questionnaires. The Norwegian Statistics Act of 16 June 1989 permits Statistics Norway to make use of national administrative registers and to collect information from businesses that is needed to provide statistics. The Act also permits the NSI to impose compulsory fines on those who do not supply information in

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<sup>1</sup> When the questionnaires are returned to Statistics Norway, they are scanned and loaded into databases.

compulsory surveys. The Statistics Act has contributed to a high and stable response rate for the Norwegian CPI.

Statistics Norway also uses interviewers for the CPI data collection. The sample of outlets is selected from Statistics Norway's Business Register for a period of six years, which means that one sixth of the outlets are replaced each year. Interviewers are used for pre-collection visits where the price collection procedure is explained to the new outlets and the item selections made. Interviewers are also used to collect monthly rents for housing, using computer-assisted telephone interviews.

Until the beginning of the 1990s, interviewers were used more extensively. Each month the interviewers would go to the outlets and deliver the paper questionnaires but the outlets themselves were responsible for filling them in. Three days later, the interviewers would return to the outlets, control the paper questionnaires and write any comments on the back of the questionnaire. Via interviewers, the paper questionnaires were sent back and forth between Statistics Norway and the outlets.

Using interviewers is costly in such an outstretched country as Norway where the labour costs are quite high. At the beginning of the 1990s, the issue of cost reductions was raised, which resulted in an attempt to reduce the use of interviewers in the Norwegian CPI. As a result, one third of the sample of outlets was selected as a test panel. The panel received the paper questionnaire by post and was instructed to fill in the questionnaire before returning it by post to Statistics Norway. After six months, the data quality and the total workload for the statistical agency was evaluated. Despite the short testing period, it was concluded that the reduction in the use of interviewers did not have significant impact on the data quality, except for a decrease in the response rate from nearly 100 to 94 per cent. Furthermore, the workload at the central office was not considerably increased, except during the period of enrolment of new outlets.

Simultaneous to the reduction in the use of interviewers, the sample of outlets receiving paper questionnaires was increased from about 1 500 to 2 200<sup>2</sup>.

### **3. New ways of collecting data**

The focus on low response burden, low costs, effectiveness and the desire to improve data quality has led to exploring the possibilities of new and more advanced data collection methods. Web questionnaires, scanner data and other ways of extracting data from databases are gradually replacing the more traditional data collection techniques.

A greater variety of data collection methods is also emerging due to gradually changing pricing structures of goods and services as well as globalisation and market changes. Deregulation and increased competition contribute to rapidly changing prices and more complex pricing structures. Prices of telephone calls, air fares and electricity tariffs are examples of areas with an increased number of data providers and/or more complex pricing structures. Changing consumer purchasing patterns also means that NSIs have to be more accommodating. The importance of the Internet as a channel to purchase consumer goods and services is continuously growing. More and more households are making purchases on the Internet, particularly for certain product groups, such as holidays and air fares.

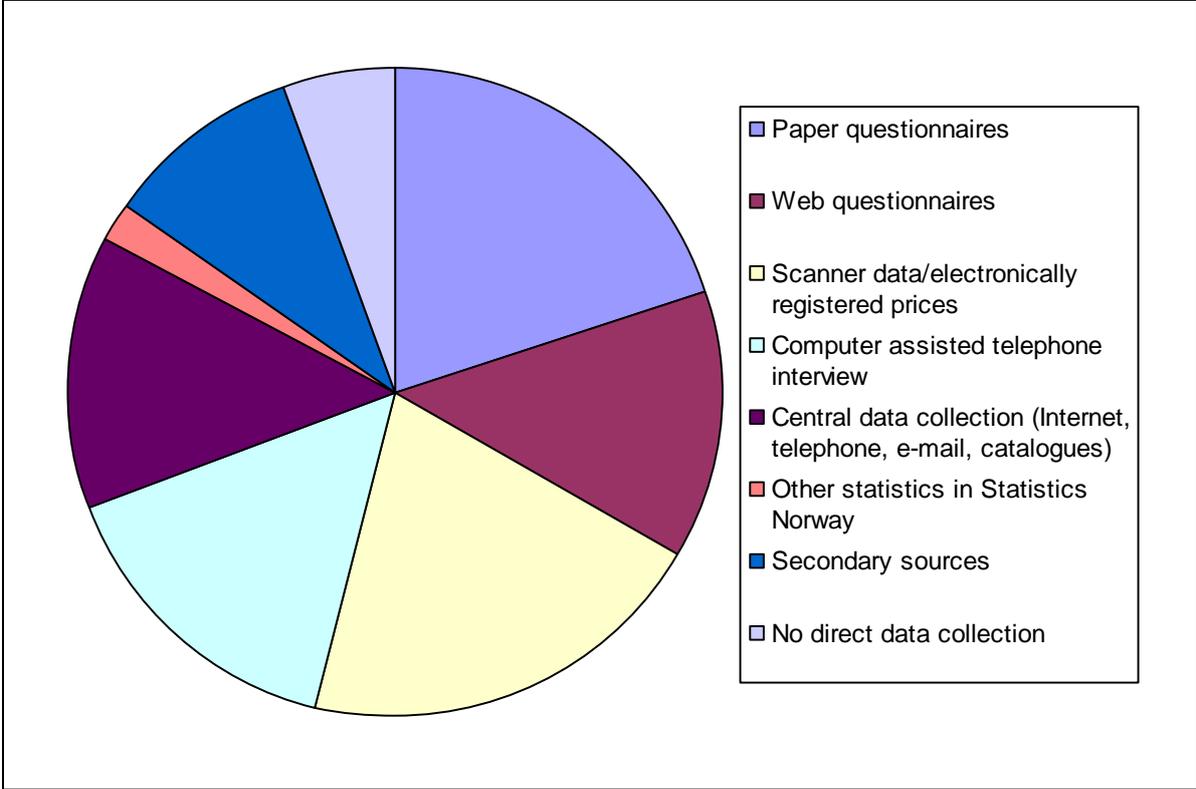
Today, paper questionnaires make up about 20 per cent of the Norwegian CPI in terms of CPI weight shares. This is a decrease of almost 20 percentage points from 2001. Web questionnaires, including data collected electronically from local governments, constitute approximately 13 per cent in 2011. Scanner data and other electronically registered prices from head offices, together with data from

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<sup>2</sup> The sample size has been more or less constant at 2 200 outlets since then.

secondary sources constitute a share of approximately 30 per cent. This is an increase of about 7 percentage points over the last 10 years; mostly due to an increase in the use of electronic data from secondary sources in areas like purchase of new motor vehicles, books and financial services.

**Figure 1. Various data collection methods in the Norwegian CPI based on CPI weight shares 2011**



**3.1 Web questionnaires**

Statistics Norway receives web questionnaires from private businesses as well as from local governments, but through different systems. In 2004, it became possible for private businesses to deliver the CPI questionnaires electronically through Statistics Norway’s own system for electronic exchange with businesses (IDUN). The choice of questionnaire mode increased the flexibility for the data providers, but the response was rather poor, especially in the beginning. Today, about 35 per cent of the respondents who deliver a questionnaire choose the online version instead of the paper questionnaire.

The CPI data from local governments is collected electronically through “KOSTRA”, which is an abbreviation for "Municipality-State-Reporting"; an overall system for electronic data reporting and publishing in Statistics Norway. The KOSTRA project started in 1995 as a project with four municipalities as participants. The number of municipalities gradually increased, and by 2002 KOSTRA had achieved full-scale reporting. All data is reported electronically, by means of electronic questionnaires or file extracts.

**3.1.1 From paper to web questionnaires – some implications**

Collecting data through paper or the electronic equivalent brings many of the same challenges, such as the importance of motivated respondents and good questionnaire design for a successful collection of prices. Motivated respondents play a crucial role in achieving the highest level of data quality as possible from questionnaires. Important factors influencing the respondents’ motivation are response

burden, interviewers' first visit to the outlets, the information flow between the outlets and the statistical agency in general and the design of the questionnaire. In addition, the definition of representative items and well-established data editing routines are also considered to be important in relation to the data quality.

When the businesses themselves have the responsibility for filling in paper or web questionnaires and returning them to Statistics Norway, we have limited control of the input in the survey. Automatic controls of the questionnaires in order to ensure that they are filled in correctly are crucial for the data quality in the survey. In cases where we suspect that respondents have failed to complete the questionnaire accurately, for instance by reporting the same price over subsequent months or where the handwriting is difficult to decipher, we contact the outlets either by telephone, letter or e-mail. Some kind of follow-up of the businesses is inevitable in order to ensure satisfactory data quality.

Compared to paper questionnaires, the CPI web forms have the advantage that they have built-in validation checks that look for obvious errors before the form is submitted to the statistical office. Major price changes are flagged and must be approved by the respondents before being accepted by the statistical agency. With that, some of the editing process is transferred to the respondent, where the expertise is, and at the same time, shortening the editing process at the NSI.

The flexibility and the option for respondents to report data online will most likely increase respondents' motivation and thereby the data quality. More motivated respondents and built-in validation checks increases the quality of the CPI data reported via web questionnaires compared to the data reported by paper questionnaires. Still, the way Statistics Norway has designed the questionnaires, the data coverage is practically the same regardless of which questionnaire mode is used. Other data collection methods however, like scanner data or other electronically registered data, may provide greater quality improvements.

### **3.2 Scanner data and data from secondary sources**

An overall goal in Statistics Norway is to collect data efficiently with lowest possible response burden. The effort of implementing scanner data in the Norwegian CPI has therefore had a high priority for several years, and scanner data are now the main data source for several consumer groups. The transition from paper and web questionnaires to scanner data has not only been motivated by reducing the response burden on businesses, but also from a data quality perspective. The most important quality improvements are reduced risk of manually reported errors and significant expansion of the data coverage, both in terms of the product sample and the range of available variables. Compared to paper or web questionnaires using scanner data also makes it easier to cover longer data collection periods which is in accordance with the Eurostat regulation on temporal coverage of the price collection in the HICP.

In recent decades, the concentration of retail chains in Norway has increased. There are four major retail chains covering most of the Norwegian grocery market. Pressure from the outlets to supply data from the head offices has grown. In Norway, the chains have great incentives for supplying scanner data in order to reduce the response burden of delivering paper questionnaires from each individual outlet.

Statistics Norway established the first contact with one of the retail chains in the late 1990s, and since 2001 we have received scanner data from all food chains. A few years later, we started receiving scanner data from pharmacies, and since 2011 we have covered the three largest pharmacy chains. We also receive scanner data from one petrol station chain. The data is collected free of charge. In general, Statistics Norway has a policy not to pay for any data used in official statistics in accordance with the Statistics Act.

The scanner data items are identified by an EAN (European Article Number), an international retail product code, and by so-called internal PLU<sup>3</sup> codes. These codes are scanned into the cash registers of retail outlets when the items are purchased. The data used in the CPI is collected from the chains' headquarters and contains information on price, quantity, type of outlet, location, period and description of the item. The monthly price reported is a calculated price which refers to the average price of the midweek<sup>4</sup> of the month. The reported quantity refers to the quantity sold in the same week.

An alternative to scanner data is other types of electronic data from so-called secondary sources, which most often represent a number of businesses. Examples of secondary sources might be trade organisations and federal authorities. In the Norwegian CPI, we collect electricity tariffs from the Norwegian Competition Authority and transmission tariffs for electricity from the Norwegian Water Resources and Energy Directorate. Prices of new motor vehicles are received from the Information Council for Road Traffic, while book prices are received from the Norwegian Booksellers Association. Fees connected to financial services like transactions of payments are collected from the Consumer Council of Norway and the portal [www.finansportalen.no](http://www.finansportalen.no). The electricity tariffs and the transactions of payments are extracted directly from Internet portals, while prices of new motor vehicles, books and transmission tariffs for electricity are received as files via e-mail.

A widely used Internet portal in Norway is [www.finn.no](http://www.finn.no). Finn.no was established in 2000 and specialises in adverts, purchases and sales between private persons and businesses. The market place is divided up into different areas like for instance real estate, travelling and motor vehicles. Finn.no covers most of the real estate offers<sup>5</sup> in Norway with a market share of about 60 per cent of all the transactions on the open market. The official quarterly published House Price Index is based entirely on this data. Statistics Norway is currently in dialogue with the same data provider with an aim to receive data for CPI purposes, such as information on package holidays.

### **3.2.1 Scanner data – some implications**

Scanner data has been introduced step-by-step in the Norwegian CPI. When we started out with scanner data from retail chains we used it purely as a price collection source. Prices from scanner data were used to replace the prices from paper questionnaires for predefined representative items. The same procedure was followed for medical products and petrol. After some years of testing the potential for exploiting more of the information that the scanner data provides, we started calculating a monthly chained superlative price index<sup>6</sup> of food and non-alcoholic beverages in 2005, covering the whole range of grocery products. From 2012, we expanded the use of scanner data in the index of medical products by covering almost all of the products purchased by consumers.

Good quality on the input data is crucial for a reliable CPI. By using scanner data we have more control of the input data, compared to paper or web questionnaires where we are dependent upon the respondents' motivation among other things for receiving data of good quality. Scanner data from the chains' main offices contains the actual transaction price for each product, which means that the risk for manually reported errors connected to questionnaires is eliminated. We consider the quality of scanner data to be high.

The data coverage obtained by using paper or web questionnaires is limited to a sample of representative items. Scanner data or other types of electronically registered data from secondary sources however, make it possible to reach a total data coverage. For instance, one of the retail chains with the highest market share in Norway provides more than 350 000 price observations each month covering food and non-alcoholic beverages as well as other non-food items. With such a vast amount

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<sup>3</sup> PLU stands for "Product Look-Up" or "Price Look-Up", a code for items that don't have an EAN code. Mostly used for fruit and vegetables.

<sup>4</sup> Statistics Norway is now working to prolong the data collection period.

<sup>5</sup> Excluding rental property.

<sup>6</sup> At elementary level.

of data, the risk of sampling errors is reduced. However, without the right tools, the data may appear both uncontrollable and unmanageable.

The quality adjustment and calculation methods for data based on the Norwegian paper/web questionnaires are limited. Lack of information on important price determining factors makes it difficult to carry out more advanced forms of quality adjustment methods than class mean imputation. Electronically registered data can, however, provide us with up-to date product information. Such variables can be used for more advanced forms of quality adjustment methods. For instance, data received from the Information Council for Road Traffic on new motor vehicles has been used to test a hedonic method.

In addition to more detailed product descriptions, electronically registered data can also provide us with monthly information on turnover, quantity and some unique identifiers of the product, thus making it possible to calculate superlative indices and to ensure that identical products are compared between two consecutive months. The matched model approach, however, combined with the enormous range of products, makes replacement of discontinued products difficult. The method is more suitable for standardised long-life products compared to more heterogeneous products with short life cycles. For instance, a matched model method that is used in the index of food and non-alcoholic beverages in the Norwegian CPI is not suitable in the index of clothing and footwear.

The transition from paper and web questionnaires to scanner data has generally increased the response rate. Except for cases where the businesses are shut down, the non-response among the scanner data businesses are practically reduced to zero. One drawback of using scanner data or data from secondary sources is that there are normally few data suppliers, which makes the statistical agency more vulnerable if one or more data suppliers fail to deliver the data. In such cases, resuming the use of paper questionnaires for each individual outlet is always a possibility, but a readjustment of that nature takes time. It is important to establish a written contract between the statistical agency and the data supplier, however this does still not guarantee that the data will be provided. The Statistics Act of 1989 provides for mandatory reporting by providers of scanner data and even for secondary sources to provide information necessary for the production of CPI. The Statistics Act, however, cannot impose an electronic data delivery. Nevertheless, it has not been necessary so far to actively use the Statistics Act in order to force headquarters or secondary sources to supply data by using penalties for non-compliance. Using data from one or few data suppliers representing several businesses also entails a risk of undetected errors that can have a major impact due to the large weight attached to the data.

## **4. More efficient resource use?**

### **4.1 Efficiency gains for businesses?**

When discussing efficiency gains it is important to distinguish between the data collection provided by respondents through paper and electronic questionnaires, including KOSTRA reporting, and data collection carried out by Statistics Norway, such as scanner data, data from secondary sources and other types of central data collection.

Paper questionnaires entail a large burden on businesses. A high response burden may result in less motivation among businesses to deliver data timely and accurately. The introduction of web questionnaires does not automatically reduce the outlets' response burden. The actual time spent filling in questionnaires can turn out to be exactly the same. Paper questionnaires may, however, be perceived as old fashioned and ineffective, and a more modern data collection process may contribute to reducing the perceived burden of filling in questionnaires.

Compared to different short-term statistics for the manufacturing sector, where the share of web questionnaires is 80-90 per cent, the share for the CPI based on web questionnaires is low. This proves that many local outlets in the CPI sample do not regard the web questionnaires as the most convenient way of reporting price information. CPI respondents include large retail chains, but also kiosks and many smaller outlets without Internet access or where the price information may not be easily accessible electronically. Returning the questionnaire by post may seem just as easy. Statistics Norway has already made the decision to discontinue the paper questionnaire offer. The plan is that data providers will have to take out a subscription in order to get paper questionnaires as from mid 2012. When forced to report via the Internet, some respondents will soon realise its benefits, while for others the reduced flexibility may only increase the burden.

The set-up costs of implementing scanner data or data from secondary sources delivered to Statistics Norway are rather high both for the data supplier and the recipient. Written agreements must be finalised and IT systems and technological solutions must be adapted and established. Once a reporting system is established, the cost for the data supplier is strongly reduced. Today, one retail chain automatically makes “drops” of data every week, but for other chains or secondary sources the process of delivering data involves some kind of manual work. Still, the transition from paper and web questionnaires to scanner data has definitely been an efficiency gain for the businesses.

The average time the respondents use for delivering data to the CPI each month has fallen due to the introduction of scanner data. In earlier years the many-paged questionnaires directed towards the grocery market were the most time-consuming. In 1995, shopkeepers used approximately 33 minutes on average per month filling in the food questionnaires. In comparison, the average overall time was about 13 minutes. In 2001, the retail chains’ headquarters took over the data reporting for food products, but also for other types of products typically sold in a retail store, like tobacco, detergents etc, which constitute a weight share of about 18 per cent of the total CPI. As a consequence the average time fell to approximately 7 minutes among the CPI respondents.

## **4.2 Efficiency gains at Statistics Norway?**

### **4.2.1 Increase in full-time equivalents**

Time use surveys have shown that the time spent by respondents filling in CPI questionnaires has declined due to the introduction of new data collection methods. The time spent in the statistical office producing the monthly CPI/HICP in 2011 has, however, increased by over 30 per cent compared to 2001. Does this mean that new data collection methods are providing more complicated CPI production?

Back in 2001, about 8 full-time equivalents (FTEs) were involved in the monthly CPI/HICP production and development. About 5 FTEs were linked to different CPI-related activities outside the Division of Price Statistics, such as the enrolment of outlets and the central data entry. The number of both monthly production staff and staff involved in the central data entry has increased since then. Today, about 11 FTEs are directly involved with the monthly production and different development projects within the Division of Price Statistics.

### **4.2.2 More complicated CPI production?**

The increase in the number of FTEs during the last 10 years is clearly a result of several factors. The most obvious and easily measurable factor is the increase in the number of official statistics within the Division. Several indicators for underlying inflation, such as the CPI adjusted for tax changes and without energy products (CPI-ATE), as well as the Rental Market Survey and the CPI for the Island of Svalbard, have been developed during this period and have clearly affected the resource use. Nevertheless, the increase in FTEs may also be a result of several changes within the CPI production process caused by new data collection methods.

Compared to paper questionnaires, the data collection process based on web questionnaires is less time-consuming as the questionnaires do not need to be scanned and registered and information interpreted in the same way. The online process is more efficient and easier to automate and streamline. A well-functioning system of web questionnaires, however, requires knowledge and technological expertise along with a well-developed support service directed both towards the respondents and the statistical agency.

Despite an increase in the number of FTEs both in the Division of Price Statistics and the central data entry, the use of interviewers has been reduced. Businesses reporting scanner data don't have to be bothered by interviewers for pre-collection visits. The enrolment of new outlets is now handled from the central office. Simultaneously, the costs for postal services have declined.

As mentioned, implementing scanner data or data from secondary sources takes time and entails rather high set-up costs. Statistics Norway has invested a great deal of resources in establishing and maintaining the network of contacts to ensure a stable data delivery. The high set-up costs also cover work connected to testing the contents and definitions in external databases, identifying variables, classifying large amounts of data, developing new data editing and calculation methods, and last but not least, implementing an efficient production system. If the production system is established as a separate system, this must be linked to the rest of the CPI system in a practical and flexible way.

Large parts of the production system have changed significantly during the last 10 years as a result of new data collection methods. For one thing, the use of scanner data usually involves some degree of maintenance of the connection between EAN codes and some group level. For sub-indices where we only use the price information for pre-defined representative items, the rest of the production process is the same as for paper questionnaires. However, for consumer groups entirely based on scanner data or other types of electronically registered data, the possibilities are numerous and the production routines are less uniform than before. What is considered to be the most appropriate calculation method for a specific consumer group varies between consumer groups and so does the available variables from the different data suppliers, enforcing different production systems. Different methods and production systems for different consumer groups is more time-consuming for Statistics Norway compared to a standardised uniform system, and requires more expertise, which in turn involves more training of staff.

CPI is, in practice, a sample survey. Total coverage of either municipalities or outlets is normally not necessary to provide reliable results. Sub-indices like public kindergarten fees, technical fees connected to dwellings and fees for home care were previously sample based, but are now collected through KOSTRA. The KOSTRA reporting has made it possible to collect data from all municipalities in Norway. The data collection process is effective and robust, but dealing with total coverage is administratively more resource demanding. Data collection resources are limited and should be used wisely. Ideally, resource-demanding methods should be limited to goods and services with complex pricing and price dispersion.

Scanner data information has also been a data source in different PPP (Purchasing Power Parities) surveys. PPP surveys started using scanner data for food products in the calculations in 2003. From an efficiency perspective, it is very attractive to construct both CPI and PPP from the same price data. Normally the PPP surveys collect their price information from outlet visits as well as from paper questionnaires. Replacing the more traditional data collection methods with scanner data has been very effective. Besides the price information, PPP surveys also make use of volume figures to identify representative items.

## 5. Conclusions

Statistics Norway, like many other statistical agencies, aims at securing data collection methods that provide more information and have higher quality, lower response burden and lower cost. The data collection methods in the Norwegian CPI have changed during recent decades and are today based on a much greater variety of data collection techniques.

As the consumers behaviour is changing and the pricing of goods and services is becoming more complex and dynamic, the data collection methods are forced to change and modernize. In order to adapt to these changes, it seems that various collection methods are needed.

In our opinion, compared to data collected through paper and web questionnaires, scanner data and other types of electronically collected data have improved the Norwegian CPI data quality in terms of coverage and accuracy. It is also safe to say that these new data collection techniques have definitely reduced the response burden on the data providers in the cases where technological solutions have been established.

In the course of time, electronic data is becoming more and more accessible, increasing both the possibilities and the challenges for the statistical office. Simultaneously Statistics Norway endeavours to tailor the data collection to the different data providers and their preferences which increases the pressure on the statistical agency. A lower response burden and more cost-efficient process for the providers do not automatically lead to efficiency gains in the statistical agency. The number of FTEs both in the monthly CPI production as well as the data entry unit has clearly increased. An obvious reason is an increase in the number of official statistics in the Division of Price Statistics, but in our opinion it is also a result of a less uniform and a more complex CPI production system.

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