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Cross cutting issues:

Time-based pricing methods

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1. Introduction

As Voorburg Group members will be all too aware, the measurement of prices on a constant quality basis presents many challenges. Services are often produced and delivered directly to the client and are commonly tailored to meet that client's precise needs so that it is not possible to observe a price for the same service in subsequent periods. As opposed to production for example, companies in the service sector use a range of different pricing mechanisms which can make it difficult for statisticians to accurately capture price change. One of the most challenging pricing mechanisms used is the hourly rate; simple for the company to administer but difficult for the statistician to identify the cost of an individual service.

This paper will discuss the known problems with the methods used to capture changes in these hourly rates, known as time-based methods, the way that time-based methods are applied in the UK in an attempt to overcome these problems, and will suggest some alternatives to time-based methods.

2. Time-based methods

2.1 Definition

Time-based methods are pricing methods sometimes used in the compilation of SPPIs that aim to capture the price of the time spent providing a service, rather than the price of the service itself. They are generally used as a last resort, for service industries where companies tend to charge clients using an hourly rate and where it is not possible to easily identify the service provided sufficiently to use an alternative pricing method.

Time-based methods are commonly used in professional services such as accountancy and legal services where the service provided is usually highly tailored to the individual client and is not repeated in subsequent periods.

2.2 Problems with time-based methods

One of the key assumptions of time-based methods is that the service provided corresponds directly to the number of hours charged to the client. Therefore the use of this method is really only valid if the quality and quantity of hours worked remains relatively constant through time.

Another key issue of time-based methods is the difficulty in capturing changes in productivity. If a price index is constructed solely using hourly rates, then any resulting volume measure produced using this price index as a deflator will give a measure of the amount of time spent providing services, rather than the volume of services provided. These measures will not show any productivity change other than changes arising from a change in the staff structure for example, an increase in the proportion of higher paid staff.

2.3 Limitations of time-based methods – worked example

Productivity growth of an industry can be defined as growth in real value added or total output per hour worked in the respective industry. For the calculation of real value added of an industry the technique of double deflation is used. In the double deflation method, real value added is measured as the difference between real gross output and real intermediate inputs.

The OECD-presentation on ‘measuring producer price indices and productivity growth in services’¹ presented at the 2014 Voorburg Group meeting illustrated that the choice of deflator highly influences the results on productivity growth. It can be assumed that not only the choice of deflator but also the pricing method used for the production of SPPIs influences the productivity growth figures. There is a concern that time-based methods tend to result in biased GDP. In particular, for the method of realized hourly rates, there is a risk of diminishing productivity growth to zero.

In the following example we assume that we have a service output like an audit. The input for the execution of an audit for a specific client is assumed to vary from year to year. Thus, the services in two subsequent years are not comparable. It is not possible to ask for the price of a repeated service. Instead, we may ask for hourly charge-out rates or realized hourly rates. Often, the respondents complain that they are not able to report hourly charge-out rates, because they don’t calculate the prices of their services on base of fixed hourly rates. Instead the overall price of the service is a mixture of personnel costs and adaption to the market-conditions. In these cases we might ask for realized hourly rates. But what happens if the execution of an audit becomes much more efficient, e.g. because the staff gets familiar with business of this specific client? In the following year the auditing company is able to offer the service with a significant lower input. If the market-conditions allow invoicing similar prices as in the year before, the realized hourly rates increase significantly. Deflation with an SPPI calculated like this will reduce the gain in productivity to zero. Let us assume for the simplified example in the following table that the audits in the periods t and t+1 are comparable, i.e. there are no quality changes. Furthermore, let us assume that income = output = value added.

Pricing method	Period	Hours worked	Invoiced price (income)	Realized hourly rate	Price-index	Real value added	Productivity (VA/hours worked)	Productivity growth
Realized hourly rates	t	500	50.000	100,00	100,00	50.000	100,00	0 %
	t+1	450	50.000	111,11	111,11	45.000	100,00	
alternative: Specification of a specific auditing service for model pricing								
Model pricing	t	500	50.000		100,00	50.000	100,00	11,11 %
	t+1	450	50.000		100,00	50.000	111,11	

¹ <http://www4.statcan.ca/english/voorburg/Documents/2014%20Dublin/Papers/022.pdf>

Of course this example is very simplistic. In this case realized hourly rates fail to measure productivity changes because the price index is biased upwards. This leads to a real value added biased downwards and thus, to no change in productivity. If we apply the pricing method of realized hourly rates without precautions to mitigate these biases this renders the calculation of meaningful productivity changes impossible by definition of the price.

3. International best practice

The basic principles of the use of time-based methods are documented in the Eurostat-OECD ‘Methodological Guide for Developing Producer Price Indices for Services’². Further information on avoiding bias when using time-based methods is set out in a paper called ‘Addressing cross-cutting issues arising in the development of SPPIs for use in the measurement of Service Sector GDP – 2008 revision’³ presented by Matt Berger at the 2008 Voorburg Group meeting in Aguascalientes. The main points are as follows:

“In attempting to mitigate these potential biases, the implications for national statistical offices are as follows:

- a) The key feature to consider is to ensure a consistency between prices and labour input;
- b) Prices measured should be realised rates (e.g. realised hourly rates or fee income per grade of worker) – the use of salary or other input costs alone is not considered appropriate, and should not be used unless non-wage labour costs, profit margins, discounting, insurance, rent, and other overheads are also included as part of a model based approach;
- c) The use of time based methods should be applied in “bands of expertise”, which should be defined on the basis of
 - staffing levels
 - qualification
 - type of activity
 - type of project;
- d) Procedures should be adopted to capture changes in duties, roles and responsibilities within “bands of expertise” and where possible quantify them;
- e) Mechanisms should be employed to identify changes in coverage of billable hours;
- f) Mechanisms should be employed to determine whether realised rates have been influenced by changing technology, administrative reorganisation, or changes to billing structures;
- g) Mechanisms should be employed to detect and measure changes in productivity in individual service industries.”

² <http://www.oecd.org/economy/eurostat-oecd-methodological-guide-for-developing-producer-price-indices-for-services-9789264220676-en.htm>

³ <http://www.voorburggroup.org/Documents/2008%20Aguascalientes/Papers/2008%20-%202021.pdf>

4. UK approach to time-based methods

4.1 Methods – worked example

In the UK, time-based methods were first proposed for use in 2010 and are currently used for the following professional activities: legal services; accountancy; business and management consultancy; advertising services; engineering services; and architecture services.

When companies are first selected for the SPPI sample, they are asked to provide the number of chargeable hours worked by each grade of personnel in the provision of services in a particular product group. This is taken as the product specification and it is these hours that will be re-priced in subsequent quarters. It's important to note that it is the number of *chargeable* hours that are collected and not the total number of hours worked during the period.

Ideally we would like to collect the actual rates achieved (ie after discounts) by each grade of staff for each product group. However, during consultation with companies it was found that companies are often unable to provide this information at such a level of detail. Instead, they can only provide the total fees earned including discounts for all grades of staff for a particular product group. As a result, the method implemented aims to calculate a 'realisation ratio' which is the ratio of total fees achieved, including all discounts, to the total fees that would have been achieved if the standard hourly rates were charged. This 'realisation ratio' is then used to adjust the standard hourly rates to give an overall price for the service.

For example, a respondent may provide the following information in the base period:

Grade, position or category of personnel	Number of chargeable hours billed in the quarter	Standard hourly charge out rate (£)	Total fees using standard hourly rate (£)	Total fees billed by all grades in the quarter (£)
Partner	210	275	57,750	
Partner	190	250	47,500	
Associate	100	200	20,000	
Solicitor	100	150	15,000	
Legal executive	150	125	18,750	
Trainee	100	100	10,000	
Total			169,000	165,000

We would use the total fees billed including all discounts (£165,000) as the base price.

In the second period, the respondent may provide the following information:

Grade, position or category of personnel	Number of chargeable hours billed in the quarter	Standard hourly charge out rate (£)	Total fees using standard hourly rate (£)	Total fees billed by all grades in the quarter (£)
Partner	200	300	60,000	
Partner	210	275	57,750	
Associate	110	210	23,100	
Solicitor	120	150	18,000	
Legal executive	140	125	17,500	
Trainee	90	100	9,000	
Total			185,350	182,000

First we would calculate a “realisation ratio” for the second period using the total fees actually billed to clients and the total fee that would have been achieved if clients were charged using the standard rates only:

$$\text{Ratio} = 182,000/185,350$$

$$= 0.982$$

Then we would use the hourly rates provided in the second period, to re-price the hours billed in the base period since it is the hours worked in the base period that we consider to be ‘the service’:

$$\text{Re-priced base period hours} = 210*300 + 190*275 + 100*210 + 100*150 + 150*125 + 100*100$$

$$= \text{£}180,000$$

And finally, we would use the realisation ratio, to adjust the re-priced base period hours to give us the overall price for the second period:

$$\text{Price} = 180,000 * 0.982$$

$$= \text{£}176,747$$

Giving us a price relative of:

$$\text{PR} = 176,747/165,000$$

$$= 1.07$$

4.2 Accounting for productivity

By collecting hours worked and hours billed by grade, it is expected that some productivity changes will be captured by the methods alone. In addition to this, our questionnaire asks respondents to provide information about changes in the company that are likely to affect the price or the quality of the service. The question as it appears on the questionnaire is as follows:

“It is important that we capture any changes to your business that may impact prices or the service offered to ensure price changes are measured on a comparable basis.

Please use this space to provide any relevant additional information about the data that you have supplied, for example:

- changes that are likely to impact productivity such as the introduction of new technology, system changes or training;
- revisions to grading structure previously provided;
- reasons for any changes in standard hourly rates since the previous period, such as increases in labour costs;
- changes to main area / ownership of business;
- change to the currency used in your quoted price.”

4.2.1 Example – new member of staff

If a new, untrained member of staff were to join a company, this is likely to result in a fall in productivity as the new member of staff is learning the new job. This would result in the company returning fewer chargeable hours worked for that grade, since the company wouldn’t charge the client for non-productive hours. Due to the fact that it is the chargeable hours worked in the base period that are re-priced however, this would mean that the price index would show no price movement.

Using the example above but assuming the company does not offer any discounts so the ‘realisation ratio’ is fixed at 1.0:

Grade, position or category of personnel	Number of chargeable hours billed in the quarter	Standard hourly charge out rate (£)	Total fees using standard hourly rate (£)	Total fees billed by all grades in the quarter (£)
Partner	210	275	57,750	
Partner	190	250	47,500	
Associate	100	200	20,000	
Solicitor	100	150	15,000	
Legal executive	150	125	18,750	
Trainee	100	100	10,000	
Total			169,000	169,000

Base period price = £169,000

In the next period, the existing legal executive is replaced with a new member of staff who works fewer chargeable hours as a result of them learning the new job:

Grade, position or category of personnel	Number of chargeable hours billed in the quarter	Standard hourly charge out rate (£)	Total fees using standard hourly rate (£)	Total fees billed by all grades in the quarter (£)
Partner	210	275	57,750	
Partner	190	250	47,500	
Associate	100	200	20,000	
Solicitor	100	150	15,000	
Legal executive	90	125	11,250	
Trainee	100	100	10,000	
Total			161,500	161,500

Re-pricing the hours in the base period give us:

$$\begin{aligned} \text{Re-priced base period hours} &= 210 \times 275 + 190 \times 250 + 100 \times 200 + 100 \times 150 + 90 \times 125 + 100 \times 100 \\ &= \text{£}169,000 \end{aligned}$$

Since the company offers no discounts so the 'realisation ratio' is 1.0, the price relative is:

$$\begin{aligned} \text{PR} &= 169,000 / 169,000 \\ &= 1.00 \end{aligned}$$

Using the UK, method, it is only information about the hours for which clients are actually charged that is collected. It is expected that employees are contracted to work the same number of hours each quarter, so in the example above, the hours worked will be the same in both periods (let's assume it's 1,000 hours for all staff). The hours worked will be greater than the hours charged as it accounts for time lost due to, for example: administrative tasks not directly related to service provision; travelling to meet with clients; office meetings etc.

If, as for the example in section 2.3 we assume that income=output=value added, then:

$$\text{Base period real value added} = 169,000$$

$$\text{Therefore base period productivity} = 169,000 / 1,000 = 169$$

$$\text{Second period real value added} = 161,500$$

$$\text{Therefore second period productivity} = 161,500 / 1,000 = 161.5$$

Thereby showing a 4.4% fall in productivity.

4.2.1 Example – new IT system or software

The introduction of a new IT system or software package is likely to have a positive impact on productivity if it means that the company can provide a service to its clients in a more efficient manner. For example, if an architecture company was providing hand-drawn technical drawings to its clients and then introduced a computer system such as CAD this would mean that they could produce more drawings in the same amount of time. Supposing the company could produce two drawings in one hour when previously it took them an hour to do a single drawing, all other things being equal, the company may double its hourly rate.

In the base period, prior to the introduction of the new computer system, when the draughtsmen are producing drawings by hand, the company may provide the following information, giving us a base price of £50,000.

Grade, position or category of personnel	Number of chargeable hours billed in the quarter	Standard hourly charge out rate (£)	Total fees using standard hourly rate (£)	Total fees billed by all grades in the quarter (£)
Senior draughtsman	100	250	25,000	
Draughtsman	100	200	20,000	
Total			45,000	45,000

If new computer software was introduced so that in the second period the draughtsmen worked the same number of chargeable hours but could now produce double the number of computer aided drawings they may double their hourly rate so that the price per drawing stays the same.

Grade, position or category of personnel	Number of chargeable hours billed in the quarter	Standard hourly charge out rate (£)	Total fees using standard hourly rate (£)	Total fees billed by all grades in the quarter (£)
Senior draughtsman	100	500	50,000	
Draughtsman	100	400	40,000	
Total			90,000	90,000

Using a time-based method this would appear to be a price increase since the hourly rate has doubled for both grades of staff, but this wouldn't account for the fact that the draughtsman can now produce two drawings an hour – ie the price per drawing has stayed the same.

Using the UK, method, this step change in productivity would be identified using the comments collected from the respondent on the questionnaire. This should lead to the respondent being telephoned to confirm whether the price increase observed is a true price increase or whether it's just a result of the increase in productivity. If it is the latter, the index would be quality adjusted to remove the price movement.

If the index is quality adjusted so that the price relative is 1.0, and we assume that the total number of hours worked by both grades is 250 each quarter then:

Base period real value added = 45,000

Therefore base period productivity = $45,000/250 = 180$

Second period real value added = 90,000

Therefore second period productivity = $90,000/250 = 360$

Thereby showing a 100% increase in productivity.

4.3 Issues with UK approach

Despite carrying out extensive industry research prior to using time-based methods in the UK, these methods still present a number of issues which are difficult to overcome.

4.3.1 Mismatch between hours worked and hours billed

To adjust the standard hourly rates, the UK method collects the total fees charged to clients and calculates a realisation ratio. As a result, it is important that the hours and the fees provided on the questionnaire refer to the same time period. Although initial industry research suggested that this wouldn't be a problem, many companies are unable to provide data on a consistent basis. This causes the realisation ratio calculated to be very volatile which, in turn, causes volatility in the resulting index. To overcome this, standard hourly rates are collected without adjustment with the realisation ratio which means that discounts are no longer captured for these companies.

4.3.2 Large numbers of staff grades

Companies often have a much more complex and extensive structure that was first anticipated when the indices were initially developed, with some companies returning information on hours worked and hourly rates for as many as 50 different grades. This is not only burdensome on respondents but it causes operational difficulties too. In the UK, questionnaires are still issued on paper and, generally, are automatically scanned onto IT systems. Since the number of grades can be so different for different companies it has not been possible to programme systems to scan and automatically enter data for these time-based questionnaires so they need to be manually entered. This is time-consuming, costly and increases the risk of errors.

4.3.3 Coverage of total fees charged

In addition to the importance of the hours and fees referring to the same time period, it's also important that the total fees charged relate only to the time spent by the company's employees in provision of the service. From industry research it seems likely that for some industries, in particular engineering services, the total fees may also include fees generated by additional items such as leasing of specialist equipment. It's also possible that some companies may subcontract some of the work to a second company. In these cases, the fees generated as a result of subcontracting would be

included in the total fees charged to clients, but they would not be included in the chargeable hours worked by company employees.

These inconsistencies haven't caused any particular problems for the UK and haven't been addressed in anyway but they do represent a flaw in the method as it currently stands.

4.3.4 *Operational difficulties*

In the UK, it is the responsibility of a separate division to collect and validate the data collected on questionnaires, rather than the price index statisticians. This is acceptable for the more straightforward, repeated contract SPPIs or for the prices of manufactured goods collected as part of the PPI but the data collection division struggle with the concept of time-based indices. The examples presented above on accounting for productivity are heavily simplified and the decisions involved when working with real companies is very difficult. As a result, it is not clear if the data actually collected and the quality adjustments made are actually working in practice as they should be in theory.

5. Alternatives to time-based methods

In the previous sections we discussed some of the drawbacks of time-based methods. In the next section we will discuss some alternatives to time-based methods, using the Dutch SPPI to suggest industries where these methods work in practice and the key conditions required for these methods to work well for other industries. Methods we will discuss are: repeated services; model prices; unit values; and a brief overview of some alternative methods.

We begin this section with an example in which time-based methods do not generate reliable price indices anymore. In the rest of the article we investigate whether other methods suggested would lead to better results for this example.

5.1 Example – Tax Offices

Currently in the Dutch SPPI, realised hourly rates are used for 69.2 (Accounting, bookkeeping and auditing). Recently we had a discussion with the Dutch Association for Administration and Tax Offices to investigate possibilities for new methods of price collection. In the past there was (assumed to be) a relatively stable relationship between total hours worked on a project and the total revenue on the same project. Nowadays administration is computerised on a large scale, a change which has encouraged companies in 69.2 to shift to other activities such as consulting. These activities are rarely based on the basis of a number of hours worked, a more common way is to use constructions based on subscriptions or packages. This means that a customer pays a monthly or yearly fee for a number of predefined activities. The number of hours worked can vary significantly.

Another method that is used increasingly is value pricing. In this method (which is also used in some restaurants), no price arrangements are made ex ante. The customer simply pays the amount he thinks the service is worth.

The Dutch Association for Administration and Tax Offices also conduct a price monitor of their own. They used to apply roughly the same methodology as Statistics Netherlands (realised hourly rates)

but now they use an approach according to which respondents can estimate a price for predefined packages of/subscriptions to predefined services. This is a bit similar to model pricing.

5.2 Repeated services

A method that can sometimes be used is the repeated services method. In this method in each period transaction prices are recorded for the same or almost the same service. The services recorded have to be representative for the total package of services provided. We will give some examples of branches where this method appears to work well.

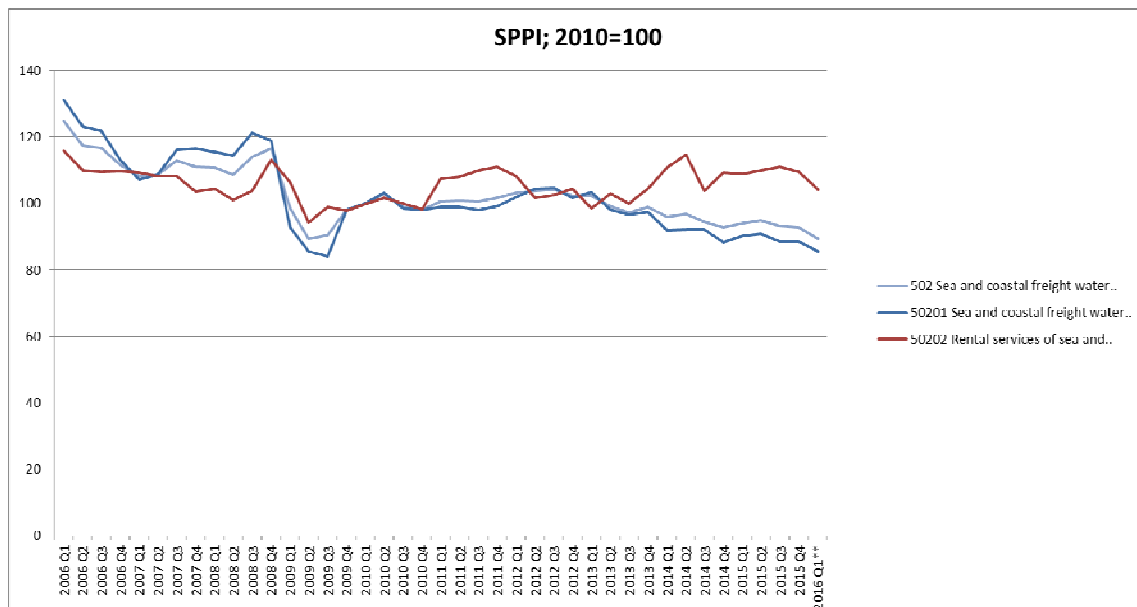
5.2.1 Sea and coastal freight water transport services (50201)

For sea and coastal freight water transport services, prices are collected for container line services (parameters: destination, number of containers, type of cargo), dry bulk transport, tankers and time charter prices. These services are exploited on a regular basis in roughly the same form. Prices are mostly influenced by:

- Supply and demand factors
- Exchange rates (EUR-USD)
- Regulation
- Bunker adjustment factor (BAF)

For this industry a second method is also used, based on unit values. For this method, in each month the total revenue is divided by the number of transport days (stratified by vessel types). The relative weight of this method is relatively low.

Figure 1. Dutch SPPI for Sea and coastal freight water transport services (ISIC 50)



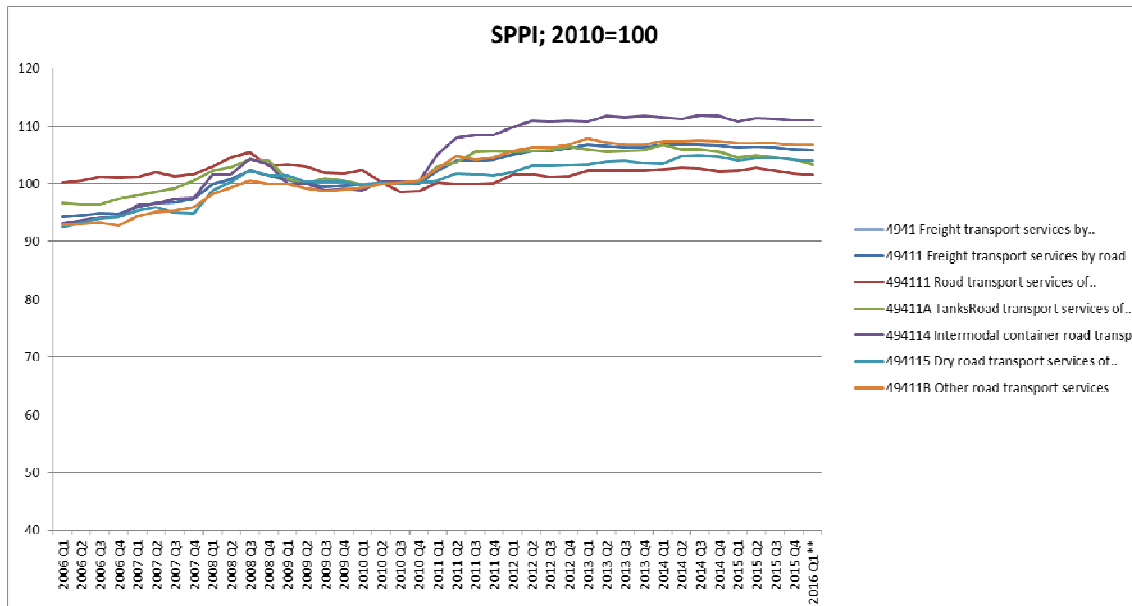
5.2.2 Freight transport services by road (4941)

For freight transport services by road CBS collects prices for road cargo transport (parameters: type of cargo, type of packing, weight, number of stops, place of departure, place of destination etc.).

Main factors that determine prices are:

- Prices of petrol and diesel
- Supply and demand factors

Figure 2. Dutch SPPI for Freight transport services by road (ISIC 49)



Of course there is no way to test whether the indices produced for these industries reflect the average price developments accurately. There are however some factors that enhance confidence in these price indices:

- Prices do not often remain the same in two consecutive quarters for the same respondent;
- Prices largely move in the same directions between respondents;
- In a given period respondents often mention the same phenomena to explain price developments; and
- Price developments are roughly in line with market developments.

5.2.3 Conditions required for repeated services

It is clear that real transaction price for repeated services can only be applied under circumstances that are not met for many industries in the service sector. For most service activities there is simply too much variation in output.

In summary the real transaction prices method seems to work well when:

- Well-defined services are provided on a regular basis;
- If the actual service is occasionally not available in a certain period the price of well-defined services can be easily estimated; and
- If necessary (explicit) quality adjustment can be applied.

Main risks of the application of repeated services:

- If real transaction prices can be measured, there might be a tendency towards sticking to these (easily measurable) services which need not always be representative for the total of the industry or respondent. We do not have any concrete signals for this bias however.

5.2.4 Can repeated services be used for the Tax Office example?

For the tax office example it is apparent that the transaction prices of repeated services method would not be a viable alternative since services provided are too heterogeneous in most cases. If there are services which are provided every quarter in the same form they would probably not be representative for the whole of tax office services.

5.3 Model pricing

Model pricing is used on a large scale in the Dutch SPPI and is generally preferred to realised hourly rates. The general implementation of the method in the Dutch SPPI allows for some flexibility. A model is usually presented in the form of a tender for which the respondent can estimate a price. In most cases these tenders are tailored to the respondent to some extent. The model is predefined roughly by CBS (on the basis of earlier contacts with businesses) and the respondent can adapt certain parameters to adapt to his own situation. The respondent is subsequently asked to give a price quotation for the model as specified in the first period. In most cases this will be a fictitious price quotation because this exact service has not been sold in the period under review.

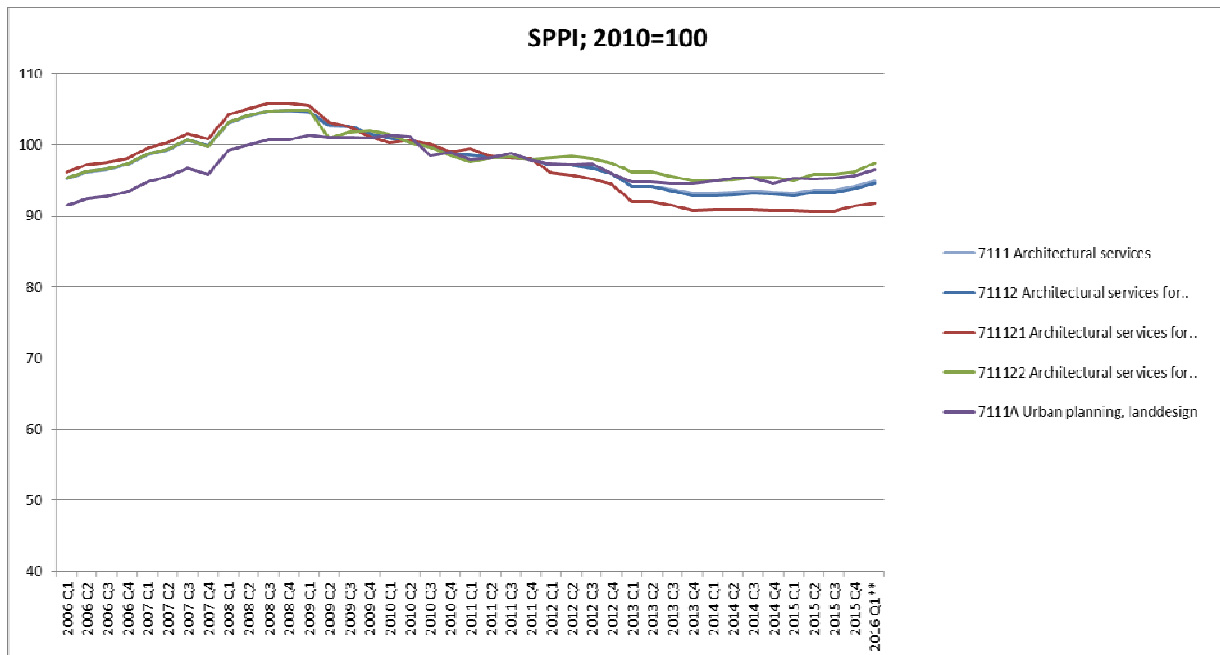
When models become outdated they can be replaced at the respondent level. In this case quality adjustment (QA) may have to be applied. In most cases data for explicit methods of quality adjustment (e.g. quantity adjustments, option pricing, hedonics) are lacking. As a consequence frequently used methods for QA are bridged overlap and expert judgement.

5.3.1 Architects (7111)

For architects, respondents can choose between two types of models in the Dutch SPPI. In the first period they can choose one of these models and fix their parameters. In the consecutive periods they have to estimate a price for the model specified in the first period.

- Model 1: project based on working hours for function descriptions used in different phases of the project
- Model 2: tender for an assignment based on type of assignment, characteristics of the building, complexity, duration of the assignment, number of fte involved etc.

Figure 3. Dutch SPPI for Architects (ISIC 71)



The price development is mainly determined by the housing market and the market for office buildings. Also the development of wages is of influence.

Architects (Nace 7111) is one of the branches CBS has scheduled for redesigning the pricing method. The main reason for researching the index for architects was the flatness of the index in the recent quarters and reports from some respondents that the models are not detailed enough. Recently the umbrella organisation for architects (Branchevereniging van Nederlandse Architectenbureaus, BNA) has been contacted. In their view there was no reason to revise the currently used price models since price determining characteristics are captured in the models used. Wage development is the most important factor with ICT and office costs also playing a significant role in determining prices.

BNA indicated that the price development was in line with what they expected. Prices are under pressure because the number of self-employed architects has grown and this, in turn, enhances competition. During the last three quarters prices have risen as a consequence of the improving housing market.

5.3.2 Conditions required for model pricing

Based on the use of model pricing for Architects and experiences of using this method for other activities, model prices seems to be an appropriate method when:

- The number of price determining characteristics is not too high;
- All these characteristics can be summarised in a simple and conveniently arranged model;
- Price mechanisms are relatively stable and do not change too often/drastically; and
- There is a relatively solid basis for applying explicit quality adjustment.

The downside of applying model pricing is that it involves some serious risks:

- Response burden: determining a price for a real tender often takes a lot of time. The same is true for a fictitious tender (model). In case of big companies often more than one department is involved in setting the price. Furthermore it can be very difficult to capture all the price determining characteristics.
- Credibility: respondents sometimes report that models used by Statistics NL do not reflect the actual business well and therefore will not generate reliable price indices. This can influence the perception of Statistics NL by respondents which is harmful. To maintain credible models that are able to reflect the actual situation, many details are needed. Moreover models will have to be updated frequently. This in turn puts a high burden on statistical offices
- (Too) flat indices: as a consequence of the high response burden of model pricing, respondents may be inclined to report that prices have remained the same as last quarter, regardless of the actual price developments. This is an easy way for the respondent to overcome the response burden.⁴
- Quality adjustment: if possible, the use of explicit methods⁵ of quality adjustment is preferred to implicit methods. In the practice of model prices, auxiliary data to support explicit methods are rarely available so that implicit methods are the only alternative. This is a serious shortcoming, especially in the case of too flat indices. It is possible that actual price changes are missed when implicit methods are used as these methods tend to follow the price development of the rest of the indices.

5.3.3 Can model pricing be used for the Tax Office example?

Model pricing could be an option for the Tax Office. For the current situation, one of the main price determining characteristics could be the price of a subscription to tax office services as this is what customers actually pay. This leaves us with a few questions however:

- To what extent does the amount of service delivered change between periods and does quality adjustment have to be applied for that?
- Is the subscriptions approach common enough to base a model upon or are many other models used in the business?
- How often do pricing mechanisms change? Is it possible to accurately measure price changes between model changes (this is important because price developments between models can in some cases be more significant than within models)

The current market developments make it difficult to specify a price model that takes account of all these questions/factors. It might be possible to specify a model that works for a number of companies for a certain time span. For the rest of the companies and the rest of the time this does not seem to apply.

⁴ Furthermore statistical offices will be more inclined to ask questions when confronted with price volatile indices than in case of flat indices, unless 'too flat' indices are closely monitored.

⁵ Explicit methods: methods that make use of actual (case/respondent specific) data; implicit methods: methods that can be used without auxiliary data and can always be applied.

5.4 Unit value methods

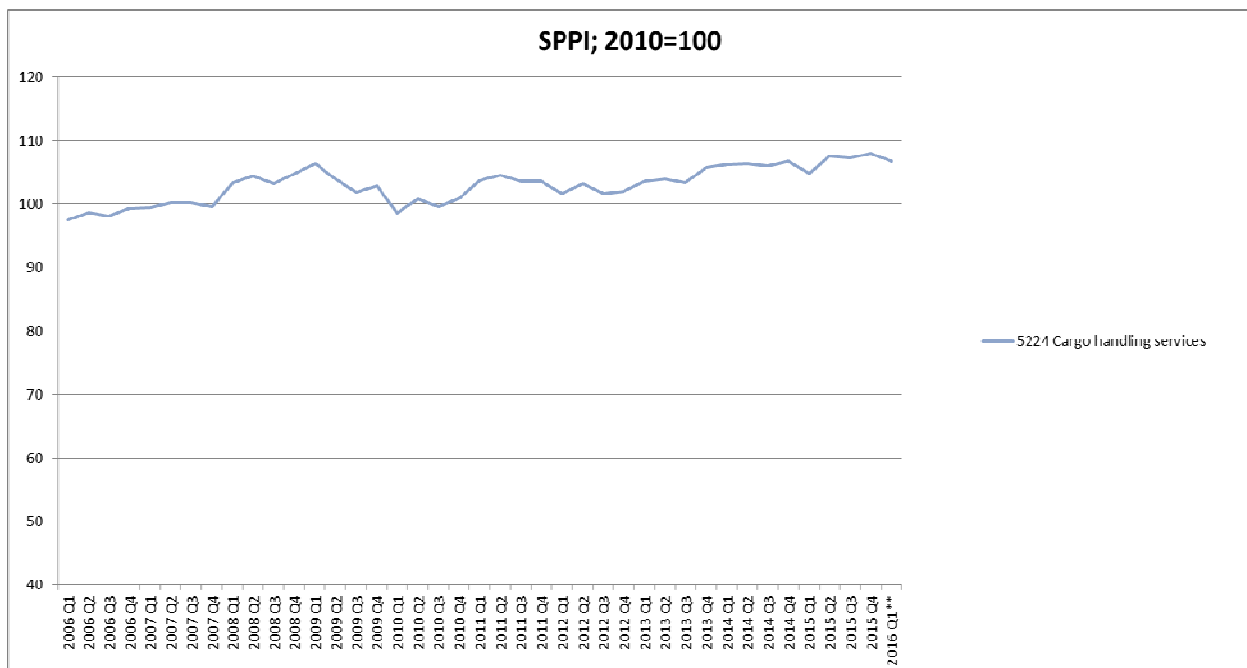
A method that is used in a number of branches in the Dutch SPPI is the unit value approach. We mention it briefly here and give one example.

5.4.1 Cargo handling services (5224)

An example of the use of unit values is Cargo handling services (5224). For these activities, respondents can report the total revenue in a period and a certain volume measure (which can be expressed in different quantities, e.g. containers, TEU etc.). This method is currently reviewed because several problems have come up:

- Mix of modalities: the number of moves (transshipment) differs significantly between periods.
- Mix of type of goods: the type of goods being transported varies every period. This is of quite some influence on the prices.
- Mix of client type: clients have negotiated different prices. The difference in mix of client types from one period to the next also affects the price development.

Figure 4. Dutch SPPI for Cargo handling services (ISIC 52)



These problems can distort the price index. To measure an accurate price development a very detailed description of all the cargo would be needed. This in turn would lead to very extensive questionnaires and probably unequal services between consecutive periods.

5.4.2 Conditions required for unit value method

In summary the unit value can generate reliable price indices when:

- The number of price determining characteristics is not too high;
- Activities can be grouped into extremely homogeneous product groups;
- All price determining characteristics can reasonably be included in the questionnaires; and
- Revenues are directly linked to volumes

5.5 Possible alternative methods

Time-based methods, model pricing and unit value methods all seem to capture price development reasonably well when the number of price determining characteristics is not too high. When this is not the case, models would become too complicated to remain workable. Also realised hourly rates would not capture the actual price development as the rates would be too highly influenced by all kinds of external factors. For a number of service industries these criteria are not met. In particular, for businesses in which large and complex projects are common, traditional price models are not really up to the task of generating reliable price indices.

Currently CBS is investigating possibilities to deal with these difficulties. We will discuss these methods briefly here. In an ideal world these methods meet the following criteria:

1. Models should be flexible so that they can adapt to changes in pricing mechanisms;
2. Models should be simple for respondents and not too time consuming; and
3. Models should be simple for statistical offices and minimise the need to contact respondents again.

One of the alternatives to be explored further is the so called direct inquiry method. This is an experimental method where respondents are simply asked about the price *development* of their services so they don't have to report actual prices anymore. In some cases the price development quotation would have to be based on an estimate. Also the question to what extent quality adjustment has to be applied is left to the respondent. The basic idea behind this method is that most respondents are very well capable of estimating price developments. This would possibly generate more reliable price indices than those which are based on price models by statistical institutes that do not reflect (or sometimes understand) the business of the respondent.

5.5.1 Are any alternative methods appropriate for the Tax Office example?

The application of traditional methods leads to difficulties for the tax offices as we have already seen. In rapidly changing markets/business models there is no service component that has enough 'fixity' for a certain time span to compare like with like. In such cases the direct inquiry method might be an alternative that leads to the least bad results. In practice the respondent would be asked for the price development of his outputs.

In practice it would still not be easy to estimate a price development between the pricing in two different business models (e.g. from hourly rates to fees for subscriptions). But in this case:

- a) The estimated price development is likely to reflect the situation at least as well as traditional models
- b) The burden on the respondents would diminish, especially when the questions can be integrated in other questionnaires
- c) The respondent is spared the frustration of filling in a traditional questionnaire in which he does not have confidence and is instead asked to give an accurate price development for his own business (i.e. might feel taken more seriously than in case of traditional models).

A key factor for the direct inquiry method is that respondents understand the concept of price development. This might seem all too evident to price statisticians but in discussions with respondents it has occurred many times that it took quite some time to get this idea across.

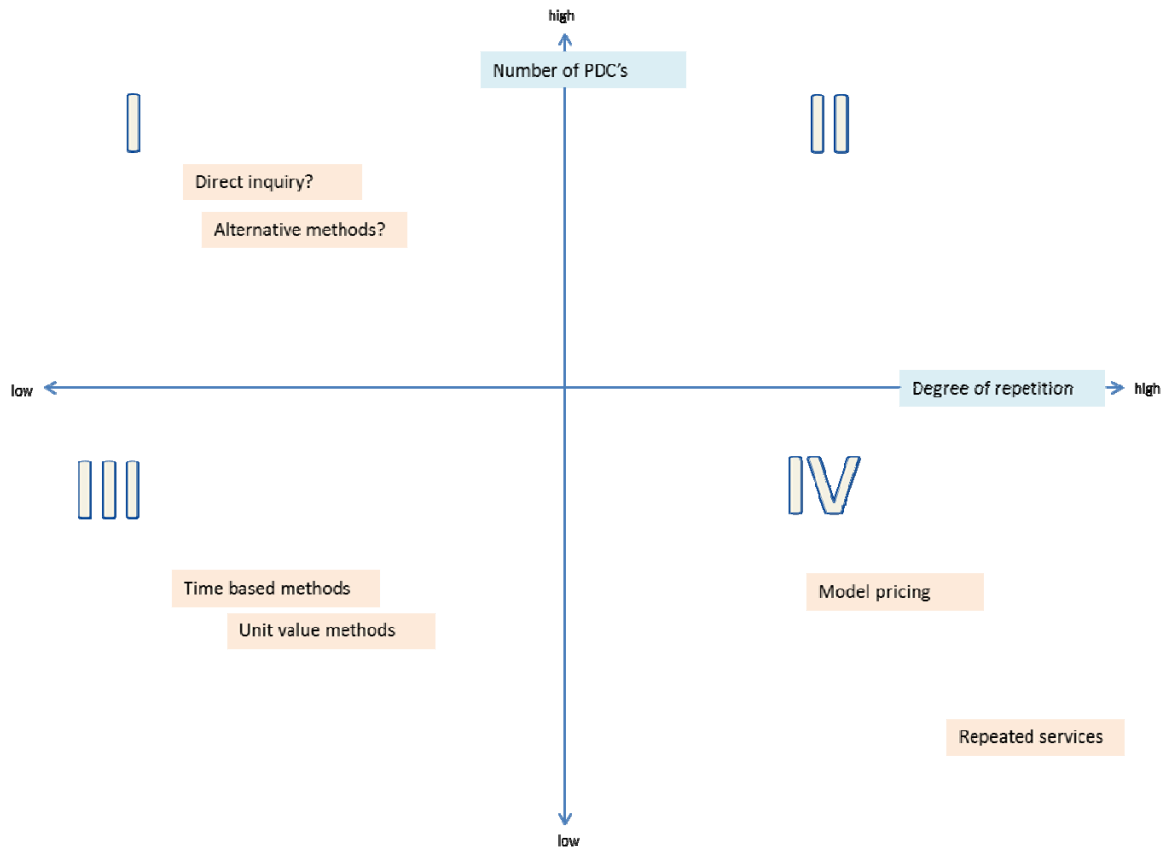
CBS is currently investigating:

- Whether/under which circumstances this method can generate reliable price indices
- Whether this method meets the current Eurostat criteria and where it needs to be adapted
- Whether the questions for the direct inquiry method can be integrated in other questionnaires (e.g. the Business Cycle Questionnaire).

Figure 5 gives an overview of the possible methods for the SPPI. Whenever the number of price determining characteristics is not too high, traditional methods seem to be adequate for capturing price developments. When the same services are delivered in many consecutive periods (or a price can relatively easily be estimated) model pricing or repeated services are good alternatives (quadrant IV). When the same (or almost the same) services are not repeated many times in some cases time based methods or unit values can work (quadrant III).

However when the number of price determining characteristics is high and projects are mostly one-off, traditional methods seem to fail. Businesses are too complex to capture into models and prices mechanisms differ largely between respondents. Furthermore, pricing methods are changing rapidly which makes it increasingly difficult to compare like with like. In these cases it seems that alternative methods are called for (quadrant I). The combination of a high number of price determining characteristics and a high degree of repetition is not common in practice so quadrant II is empty.

Figure 5. SPPI models matrix



6. Conclusions

While time-based methods are usually considered to be a last resort for most NSIs attempting to measure price change in the service sector, there are many problems associated with their implementation some of which are not always easy to identify prior to implementation. For the production of all statistics, there is always a balance to strike between a number of factors such as accuracy, cost and respondent burden, but for SPPIs, this balance can be even more difficult to get right. The big question for time-based methods is whether they are fit for purpose at all. If we are able to overcome the problems associated with productivity, discounting and minimising respondent burden, is the quality of the resulting SPPI really worthy of the effort? If they're not though, what are the alternatives?