Chapter 2. Main pricing methods for Service Producer Price Indices

The primary motivation of this chapter is to help to develop a better understanding of the variety of pricing methods used. It characterises the various approaches within a broad conceptual framework that facilitates understanding and international comparability by providing links between the various pricing mechanisms used by service providers and the methods used by index compilers to measure price change.[1]

The compilation of price indices should be based on clearly specified, representative products for which prices are tracked over time with due attention to quality change. For services, this principle is often difficult to follow:

1. Pricing (or charging) arrangements or mechanisms for the sale of services are often such that it is difficult for the compiler to observe prices for a repeated service transaction;
2. Identifying quality change can be a significant task, particularly in the context of services, where the very notion of quality is often problematic. Is a haircut delivered in one hour better or worse than a haircut that takes two hours for example?
3. Many service products are unique. In these cases, prices cannot be observed over multiple periods and so assumptions on quality changes have to be made (typically, constant quality is assumed) that are mostly based on convention rather than reflecting "reality".

In practice therefore, SPPI compilers may have to use a number of pricing methods to track price changes in service products, with the methods typically depending on the producing industry or product and on the pricing mechanisms used.

2.1. Pricing mechanisms and methods

Pricing methods refer to the procedures put in place by index compilers to make price data suitable for use in index compilation. These procedures are carried out prior to elementary index compilation and are solely concerned with data relating to prices.[2] The selection of the appropriate pricing method for a service product or industry is largely determined by the pricing mechanism employed for that product or industry.

2.1.1. Pricing mechanisms

Pricing mechanisms refer to charging arrangements put in place by economic operators. In practice service providers use a variety of mechanisms to price their output but these can be characterised under three broad groups defined as follows:

- An explicit fee/price for the service is charged and payable (excluding those services charged as a function of time-spent), and referred to, for convenience, as *explicit output charged mechanisms*;
- An explicit fee/price for the service is charged and payable as a function of time-spent, referred to as *time-spent mechanisms;*
- No explicit fee/price is charged and the payment for the service is not explicitly identifiable but is instead bundled within the price of another good or service. Two types of services are typically priced in this way. The first reflects the output of the retail/wholesale/distribution activities and the second reflects financial intermediation services indirectly measured (FISIM). This mechanism is for convenience referred to as *margin-pricing*.

Price information is available for the majority of services products. However, this price information may not necessarily meet the fundamental principle underlying price indices, which is to follow prices of products with comparable quality in consecutive periods. In other words the fact that price information is observable does not, unfortunately, mean that measuring price change is a trivial task. Therefore the compiler

must examine the available price information and determine how it can be used in index compilation.

2.1.2. Data type in surveys

A key factor in determining the range of appropriate pricing methods is the data available to the compiler. Therefore before giving an overview of the various pricing methods widely used in practice by countries, it is instructive to consider the typical price data available:

1. **Real transaction price**: the price of a service actually paid in the market, taking the form of a receipt, bank statement or electronic database. It represents the actual price paid (inclusive of any discounts, surcharges or rebates) for an individual transaction that can be observed repeatedly;
2. **List price**: a price quoted from the producer's price list, catalogue, Internet site, etc. It is generally the gross price exclusive of all discounts, surcharges or rebates that may apply to an actual transaction. A list price is therefore less suitable than a real transaction price for SPPI compilation. Note that list prices for fixed amounts of working time are known as standard hourly rates;
3. **Revenue**[3] **and amount sold**: data on both revenue and amount sold which allows for calculation of an average price for a large number of transactions. These data may be used in several pricing methods (unit value, component pricing, model pricing, and hourly charge-out rates). The revenue corresponds to the value of output sold or the value of invoiced sales of goods or services supplied to third parties during the reference period. The amount sold is a measure of the quantity of homogeneous services;
4. **Acquisition and selling prices**: data on both acquisition and selling prices where the difference between the two allows for calculation of a margin price. The acquisition price is the cost to the seller of purchasing a product or a service from a supplier excluding any taxes and rebates. The selling price is the cost to the purchaser excluding any taxes and transport charges;
5. **Percentage fees and related value**: data on both the value of a good or service, and a percentage fee from which an actual fee (price) can be calculated. The percentage fee could in practice be taken from a list, estimated by an expert or calculated as an average from real transactions. The related value refers to that of the underlying good (or other product) to which the service relates;
6. **Expert estimate**: price based on the potentially subjective judgment of the expert in the responding unit who completes the survey. The estimate can reflect different types of units, for instance only components of an entire service, or prices per working time and per product;
7. **Input data**: Price data for all (or a number of) input components needed to produce a set amount of service output. The profit margin is always to be included as an important input component. Input data can be taken from business enterprise records based on real transactions or be estimated by an expert. Strictly speaking, the input prices can be taken from a list, estimated by an expert, or calculated as an average from real transactions. However, an input price is set apart as it is not an output price.

2.1.3. Introduction to pricing methods

The following section summarises the main pricing methods used to compile SPPIs from the different types of price data. The list does not claim to be exhaustive but it does reflect an exhaustive assessment of commonly used methods:

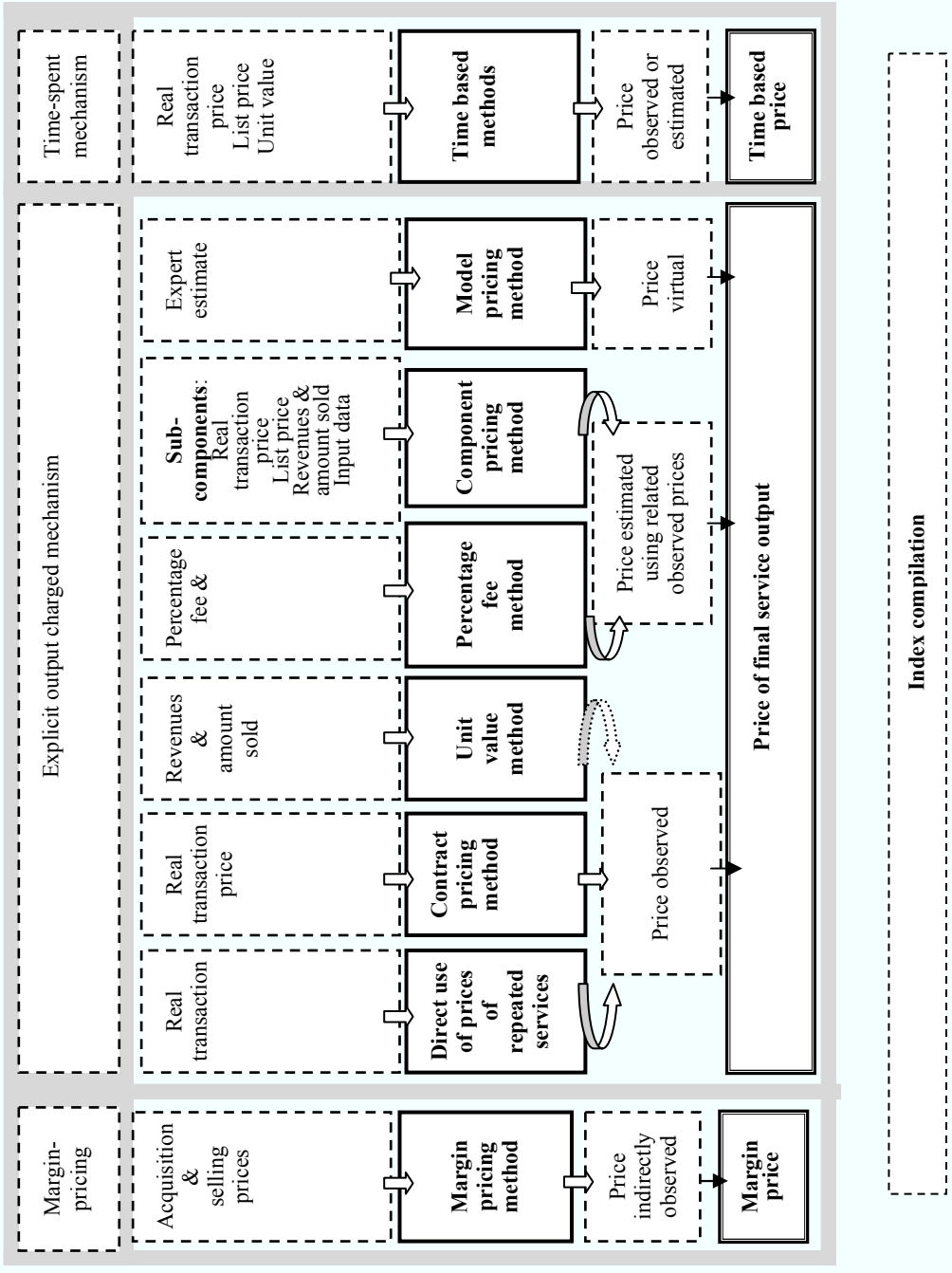
- **Direct use of prices of repeated services** represents the ideal of using real transaction prices or, less preferably, list prices, of the same service product in successive survey periods. Adjustments will be needed to account for any changes that occur when the observed product is replaced or if its quality changes. The method is discussed in section 2.2.1;
- **Contract pricing** refers to the use of prices in long term contracts for the repeated delivery of the same (or a very similar) service. This is a special case of using real transaction prices. The contract pricing method is discussed in section 2.2.2;
- The **unit value method** constructs a price index based on observed revenue and quantity data. Note that the unit value method as defined here is limited to cases where price observations refer directly to service output. The method is discussed in section 2.2.3;
- The **percentage fee method** calculates the value of the service as the product of the percentage fee and value of the product to which the fee relates. The method is discussed in section 2.2.4;
- The **component pricing method** is particularly relevant when only information on total revenues and number of sales are typically available, but where the products sold are relatively heterogeneous – invalidating the unit value approach. The approach specifies a representative product and estimates its price on the basis of the prices of identifiable components that determine the overall price. The method is discussed in section 2.2.5;
- The **model pricing method** is typically applied in cases where the service provided is unique. The approach specifies a standardised product, that is sufficiently representative of the type of service provided, and respondents are asked to provide a price quote for this standardised product. The method is discussed in section 2.2.6;
- **Time based methods** reflect cases where a service is specified in terms of the time spent providing a particular service and not necessarily in terms of the actual service provided. See section 2.2.7;
- **Margin pricing method**: Margin prices are defined here as those prices that are not directly observable but where the value of the service can be measured as the difference between the observed acquisition and selling prices of a given product. The method is discussed in section 2.2.8. It is important to differentiate this method from pricing mechanisms that may be used by typical margin charging industries. In some cases these industries will specify the price of a service for a given delivery/provision of a product, which may also be invoiced as a percentage of the value of the underlying product. In these cases the appropriate methods are those that relate real transaction prices or percentage fees. There are however similarities in practice between the percentage fee and margin pricing methods.

Box 2.1. shows the pricing methods as defined in this *Guide*. They are presented linked to pricing mechanisms and results of pricing methods (namely the price that enters into index compilation). Therefore three main classes of pricing methods are distinguished and defined as such:

- Pricing methods which result in *a price of final service outputs* (left-hand side of box 2.1.): price-determining factors of services are well-specified; they are fully defined in terms of all the characteristics that influence their transaction prices. Price observations refer directly to specified service outputs and result in prices of final services output;
- Pricing methods which result in *time based prices*: (central part of box 2.1.): price observations refer to the time used in the provision of the service rather than on the service itself. Adjustments to reflect productivity changes may be necessary;
- Pricing methods which result in *margin prices* (right-hand side of box 2.1.): price observations that are used in this method refer to the difference in the price that paid by the service provider for the good or service they transformed and the price paid by the final consumer.

The resulting prices derived from using each of the methods applied are emphasised as they are important in monitoring practices and in analysing price and volume developments across different countries. In particular, price indices based on final service outputs may need to be interpreted differently from time based price indices. In the first case, the volume of output is, in principle, correctly measured (albeit depending on how well price-determining factors are specified) but this is not necessarily the case for time based methods, particularly where quality changes have occurred in the output, or productivity changes impact on the input (hours spent). This issue is further discussed in section 2.2.7.

Box 2.1. Classification of main pricing methods for SPPI



2.2. Main pricing methods for SPPI

2.2.1. Direct use of prices of repeated services

The direct use of prices of repeated services represents the ideal and refers to transaction prices for well-specified, repeated services which can be either simple services or packages of services. It corresponds to the transaction pricing typically observed in CPI and PPI compilation. This method captures price movements of real transactions of the same service products in successive survey periods.

Data type in the survey

The price data used are ideally real transaction prices (inclusive of any discounts, surcharges or rebates[4]) extracted from enterprise records or accounts in each survey period. If real transaction prices are not directly available they can be estimated by the respondent.

List prices can occasionally be used as proxies for real transaction prices. List prices are collected from standard price lists established by a business enterprise for the service products it sells. These prices may either directly match the required service specification or be as close to it as possible if prices for the exact specification are not available. List prices should only be used in an SPPI if there are good reasons to believe that they accurately reflect the evolution of actual transaction prices. This is not the case when discounts, surcharges or rebates vary over time in response to changing market conditions.

Use of the direct use of prices of repeated services method

Direct use of prices of repeated services is the preferred and easiest pricing method because indices can be directly compiled using standard PPI compilation procedures. Respondents are asked to select a number of service products that are representative of their total output. The prices of these services are observed over time, as are their characteristics in order to control for quality changes.

While the pricing of simple services is often straightforward, pricing of service packages is more difficult when their structure changes or when customers switch their purchases towards more favourable packages. For example, in the telecommunication sector a package might consist of fixed amount of phone call minutes (perhaps further split across network providers), SMS (short message service) messages and data as well as a fixed fee. New packages which provide differing amounts of phone call minutes, SMS messages and data are regularly introduced. Older packages may become less representative over time as customers switch to new ones, thereby leading to survey bias. However, replacing less representative service packages in an index with more representative ones may lead the statistician away from the pricing of repeated services to alternative methods to ensure service products remain representative while pricing is to constant quality.

The direct use of prices of repeated services is typically used for pricing the following industries: air transport, warehousing and storage, cargo handling, postal and courier activities, telecommunication, technical testing and analysis, employment activities, food & accommodation, other monetary intermediation, security and commodity contracts brokerage, insurance activities and rental and leasing activities.

As shown in box 2.2., one of the main issues when using direct use of prices of repeated services is to define and standardise the specification of the service to ensure

that the specification continues over time. An overly tight specification entails the risk that the service may not be transacted again.

Box 2.2. Direct use of prices of repeated services: passenger car rental industry

Type of service: passenger car rental for leisure travel

Location n°: 6437500

Establishment number and street: 64375 BLS parkway, Cincinnati, Ohio 45260. Corporate-owned establishment. Airport site. Standard rate plan.

Duration of car rental period: one day

Class : standard

Age of rental vehicle: 12-24 months

Model/name of rental vehicle: Pontiac grand am

Passenger count of rental vehicle: five passengers

Daily rate

One-way rental (pick-up and drop-off points are at different locations), pick-up point: 64375 BLS parkway, Cincinnati, Ohio 45260. Drop-off point: 80631 Dol place, Cincinnati, Ohio 45309.

Unlimited mileage (no extra charge)

No fuel charge (for rental car with full tank of gas; returned with full tank).

Advance reservation.

The service is transacted every survey period. The price is the total daily rental.

Special case: the use of data collected for the Consumer Price Index (CPI)

The use of price data collected for the CPI can be considered as a special case of direct use of prices of repeated services. This situation arises particularly for service industries where the vast share of output from the sector goes to final demand. In other words, when services that are predominantly but not exclusively destined for household consumption such as passenger transportation, food & accommodation or finance & insurance, the use of CPI data may prove to be an attractive option. The use of CPI data can, in particular, help to remove or minimise the requirement for data collection.

CPI data can be used either exclusively (only CPI data are used as proxies for the SPPI) or in tandem with other producer price data not covered by the CPI, especially those relating to business users (collected by a dedicated SPPI survey). However, when using CPI data due attention should be paid to the two following issues:

1. CPI data that is used in the compilation of SPPIs must be adjusted such from valuation at purchasers' prices to basic prices by deducting any taxes including VAT and trade margins.[5] Basic prices are better aligned to the remuneration that producers actually receive to compensate them for expenditures on goods and services used as intermediate inputs, for labour costs and as a return to capital;[6]
2. When CPI data are used as a full proxy for the SPPI, special attention needs to be given to the potential for prices charged to businesses to display different trends to those charged to household consumers. The assumption that prices for business

users and households move in a similar trend, with a similar composition of consumption, should be tested.

3. CPIs are typically used as proxies in the compilation of BtoAll indices, such as postal and couriers activities, telecommunication, technical testing and analysis (of passenger vehicles) and food and accommodation services.

2.2.2. Contract pricing method

In the contract pricing method, the object of measurement is a single real transaction of service based on a contract for which prices are agreed for more than one period when the contract is signed or renewed.

Data type in the survey

Prices for the repeated delivery of the same or a very similar service in many survey periods, set out in long-term contracts are used in the contract pricing method. The method uses real transaction prices of a special kind in so far as:

- Prices in a contract are agreed for more than one period when the contract is signed or renewed;
- Prices may be the same for that period or change according to an agreed pattern.

While surveyed price data are commonly based on a "contract", this does not necessarily result in the use of the contract pricing method. In order for contract pricing to be employed the contract must cover more than one survey period, services provided in each period must be the same and prices must be agreed at the same time for more than one period.

Use of the contract pricing method

The contract pricing method works as follows:

- Specific contracts are selected during the respondent initialisation phase (see chapter 3, section 3.4.). The product description identifies the client explicitly. The nature and quantity of the service to which the price refers is also stated clearly, *e.g.* the total weekly or monthly service (coinciding with payment), or the price per unit of service delivery, for example one transportation trip, one days' cleaning or an hour of security provided;
- The price of this product is included in every compilation period although respondents in some industries have stated that prices change so rarely that the survey frequency should be lower than the periodicity of SPPI calculation. Where a contract fixes the period for which a constant quality service is provided for a specified price, this price can be used in index compilation for the duration of the contract;
- If there is any change in the actual service, a quality correction has to be made for which standard methods can be applied. For example, an office cleaning contract changes from 5 to 3 cleanings per week or the weight of the load of a road haulage trip increases from 10 to 14 tonnes.

Box 2.3. shows an example of contract pricing methods for freight transport by road.

Box 2.3. Contract pricing: Freight transport by road

Respondents provide price information on relevant routes and freight types (by customer) that they have selected themselves. Prices reported by the respondent are real transaction prices.

Prices are set in advance for several survey periods. They are updated about once a year. Fuel surcharges can be added within the contract period if agreed in the contract.

Weights are not available for each service transaction but at the level of type of service activity – consequently an un-weighted geometric mean formulation is used to calculate elementary price indices.

Service	Unit	Price		Price change	Weight
		t-1	t		
Temperature controlled transports					**0.25**
Customer A: Transport of meat, from A to B	€/10 boxes	25	26	1.040	
Customer B: Transport of fish, from C to D	€/10 boxes	25	27	1.080	
	Geometric mean			1.060	
Tank transports (fertilizers, gas etc.)					**0.25**
Customer A: Sludge, from A to B, €/ton	€/ ton	18.25	18.15	0.995	
Customer B: Acid, from C to D, €/ton	€/ ton	14.15	14.62	1.033	
	Geometric mean			1.014	
Paper and wood industry transports (paper, cartons, pulp etc.)					**0.5**
Customer C: Pulp, from A to B	€/ ton	6.70	6.9	1.030	
Customer D: Timber, from C to D	€/ ton	8.72	8.94	1.025	
	Geometric mean			1.028	
Weighted price change from t-1 to t				**1.0325**	

Contract pricing is usually relatively easy to apply where payments are made on an accrual basis - that for each individual contract the prices are fully in line with corresponding service output.

However, it is important to note that the contract pricing method can be employed only under certain conditions. Firstly, if contract pricing is based on a real transaction as in the case of direct use of prices of repeated services, there is a fundamental difference between these two methods. Contract pricing is based on a single transaction, whereas the direct use of prices of repeated services is based on multiple transactions, possibly for different clients. A contract and its price are thus usually unique for a particular client. However, as they are repeated over many survey periods the "unique product problem" does not apply here.

Secondly, the producer-client contract must cover the repeated delivery of a service over a period of time, whether predefined (for example one year) or open ended. This pricing method requires therefore that the contract lasts over a sufficiently long period (at least a number of survey periods), and that service delivery is repeated at least once in each survey period (remembering that survey periodicity and compilation periodicity do not need to be the same). However, the price specified in the contract need not be constant but may change without an accompanying change to the output specified in the contract. Prices can change via different mechanisms, for instance by yearly renegotiation, by escalation with another index such as the CPI, or by a clause that states that the producer is allowed to pass on certain cost changes (for example a fuel

surcharge). Payments are typically periodic, *e.g.* every week or month the same amount is paid.

The method should be used with caution because individual contract prices agreed in a previous period for future periods may not be representative of current price development in the industry. Therefore, a crucial concern when applying the contract pricing method is how well the resulting price index reflects price development in the industry concerned. In those service industries where contract pricing is the prevailing pricing mechanism, two issues should be considered to ensure representativeness:

1. Contracts included in the sample should preferably reflect different volumes of service deliveries because price developments may vary with the size of the customer;
2. A relatively large sample is required. Otherwise the resulting index may become too sensitive to the spread of contract periods in the sample. In other words, due attention should be paid to the temporal representativeness of the sample to capture the evolution of the market situation. It is possible that the spread of contract periods is highly seasonal, e.g. contracts are usually signed at the beginning of the year.

If there is no significant seasonal pattern in the spread of contract periods over the year and services provided by the industry are relatively homogeneous, the contract pricing method and a representative sample of contracts might result in an index that is broadly representative of the whole industry. On the other hand, if there is a strong seasonal pattern, it may be necessary to also collect prices that are based on alternative pricing mechanisms. The more prevalent other pricing mechanisms are in an industry the more important it is to enlarge the sample. This would naturally imply the use of multiple pricing methods across different respondents for the industry concerned.

Note finally, that "new sales biases" may occur when contract pricing is used. This problem arises where a new contract is won at a significantly discounted price. Once custom is secured, prices revert to regular market levels. The resulting SPPI may show an excessive price increase as the status of a customer moves from "new" to "regular". A practical solution to this problem is to avoid the inclusion of prices that are clearly discounted to win new business.

In summary, the contract pricing can only be applied if: *i*) the chosen unit of service[7] is repeatedly provided under a single contract over many survey periods and at least once per survey period and, *ii*) the surveyed prices reflect the same service each survey period. If these conditions are not met, the contract pricing method cannot be used:

- Long lasting contracts for unique services, like a three year engineering project, cannot be surveyed using the contract pricing method, because different services (or phases of a large service agreement) are produced in each survey period. For such services, model pricing or a time based method are the main options. Similarly, framework agreements under which different amounts of service or different services are delivered in each period are not suitable for contract pricing;
- Contract pricing is not recommended in cases where the same services are delivered in each period but payments are made less frequently (for example a large up-front payment). There is no way, other than by estimation, to allocate these payments over the contract period to determine prices for each sub-period

and to apply the accrual principle. It is recommended to apply other pricing methods, such as model pricing, in these cases.

The contract pricing method is typically used for pricing the following industries: freight transport by road, postal and courier activities, technical testing and analysis, cleaning activities, waste management and software publishing.

2.2.3. Unit value method

The unit value method is based on repeated real transaction of final service output for which prices are derived using respondent data that are not output prices. Service output is subdivided into homogeneous sub-sets for which value and quantity data are available. Prices are then estimated by dividing the value of service outputs by the corresponding output quantities.

The unit value method as defined here is limited to those cases where estimated prices refer directly to final service output. Cases where unit values are employed in the estimation of hourly rates are included in the section on pricing methods based on working time (section 2.2.7). In addition, in the case of the component pricing method a sub-component might be based on unit-value. This situation is covered in the section on component pricing (section 2.2.5).

Data type in the survey

Under the unit value method, the price of a service is derived by dividing revenues from sales by volumes of services provided in respect of a large number of transactions. As shown in the telecommunications example presented in box 2.4., the 'local calling price' is the total revenue from local phone calls divided by the total volume (minutes) of local phone calls.

Box 2.4. Unit value: Telecommunications (Example 1)

U.K. Business Telecommunication: Local calls

	Revenues (£m)	Volumes (million minutes)	Unit Values (£ per minute)	Index Value
Year t				
Q1	300	14,000	0.02143	100.0
Q2	280	13,500	0.02074	96.8
Q3	260	13,000	0.02000	93.3
Q4	240	12,500	0.01920	89.6
Year t+1				
Q1	220	12,000	0.01833	85.6
Q2	200	11,500	0.01739	81.2
Q3	180	11,000	0.01636	76.4
Q4	160	10,500	0.01524	71.1

The unit value method may be appropriate in cases where consistent value and quantity data are available for sufficiently homogeneous services. However, in practice the homogeneity requirement is difficult to fully meet. Even a very detailed sub-division of output does not always ensure that services are homogeneous. Although the quality of specific services might be homogeneous, measures of revenues and quantities may include contracts of different sizes (which is an important price determining factor),

undermining the feasibility of the method. Detailed sub-division of services is of the utmost importance to ensure that the impact of this problem is minimised.

There are cases, such as postal and courier services, where unit values can often be considered appropriate.[8] The unit value method may also prove to be the best pricing method for certain complex services (for example telecommunications and flight transportation services). Rapid technological development and frequent changes to invoicing systems may make the implementation of other alternatives so difficult and costly that a judicious use of the unit value method offers a feasible and cost-effective option.[9]

Note however, that a problem sometimes encountered with unit value indices is that the required data are not available in time for inclusion in current quarter estimation. This means that unit value indices are often lagged by one quarter (or month) or alternatively, indices are published preliminarily and revised when final data become available.

The unit value method is typically used for pricing the following industries: air transport (see box 2.5.), postal and courier activities, telecommunications, advertising, accommodation, waste management, publishing of books, periodicals and other publishing activities, software publishing.

Box 2.5. Unit value: Air freight transport (Example 2)

Freight rates (€/kg) are a commonly employed pricing mechanism in Air freight transportation. Rates may differ from contract to contract, between customers or according to different levels of services or goods. However, as both rates and services provided can be quite homogenous a unit value approach can be used.

Total revenue and volume data is available. For their member airlines, IATA international – the International Air Transport Association – runs an accounting system for Air Waybills. It collects information on turnover, transported volume (weight in kg), destination and carrier. With this information, unit values can be calculated for every destination and airline that subscribes to the system (and all large international airlines do). FSO Germany receives quarterly reports from IATA containing turnover and transported volume by airline and destination, and calculates unit values out of it. For example:

Airline A	Destination X	
	T	T+1
Turnover (€)	150	181
Volume (kg)	25	29
Freight Rate (€/kg)	6.00	6.24
Index value	100	104

The freight rates for airline A by destination X is calculated dividing turnover by transported volume. It contains multiple, variable transactions. The change in price is calculated by comparing the calculated freight rates: in this example, the price has risen by 4%.

2.2.4. Percentage fee method

The percentage fee method is used to measure the price development of real transactions of services that are tied to transactions of products such as goods, contracts or assets.

Data type in the survey

In this method, the percentage fee and related value of the product transacted are used to estimate the price of the final service output by multiplying the percentage and the value of the good.

The percentage fee and the value of the product value may be collected from different sources. The percentage fee can be taken from a list, estimated by an expert or calculated as an average. Often, the price (actual or index) of the good is already available to the compiler, for example in the case of a price index for leasing of office equipment rented (box 2.6.) or real estate activities (see box 2.7). In other cases both the percentage fee and product value are supplied by the respondent.

Box 2.6. Percentage fee: Leasing of office equipment (Example 1)

In the example, prices are calculated by using percentage fees and price indices. For each survey period (t-1, t, t+1 …), the compiler collects data on percentage fees and combines them with price indices for the products concerned.

Service price = 1+percentage fee (%) x price index of the product.

Service	Period	Percentage fee (%) (a)	Price index of personal computer / copying machines (year t0 = 100) (b)	Prices (1+a) × (b)
Monthly fee for leasing a personal computer valued at 250,000 yen for 3 year contract	t-1	3.0	86.5	89.095
	T	3.1	83	85.573
	Percentage change	**+3.3%**	**-4.0%**	**-3.9%**
Monthly fee for leasing a copying machine valued at 1,000,000 yen for 5 year contract	t-1	2.6	95.0	97.47
	T	2.7	94.0	96.538
	Percentage change	**+3.8%**	**-1.1%**	**-1.0%**

Use of percentage fee method

Typically, the percentage fee method is used in the real estate agencies sector where the pricing mechanism is based on real estate prices and commission rates (see box 2.7.). Other examples of services for which the method is used include the placement of advertisements, architectural services, and rental and leasing services. For this method to be employed the product to which the service is tied should be a product group rather than a strictly specified product. The latter case, where the fee for the same product for consecutive periods is targeted directly (by measurement of the difference between the acquisition and selling prices of product), is categorised as the margin pricing method.

Box 2.7. Percentage fee: Real estate activities (Example 2)

Specification of the service:

Residential property sale/purchase. Agents and brokers services provided: listing agent. Full service. Single family cooperative apartment. Address of property: 804 River RD #4f, Nowhere, NY. Other property identification: mls #2205775. Number of bedrooms: 2. number of bathrooms: 1. property value: $176,000. Commission rate: 2.00%.

The exact house has not been transacted every survey period. The property value and commission rates are updated using actual data from recent sales of comparable properties.

Period	Property value	Commission	Price	Index value
T-1	$182,000	2%	$3640	100
T	$176,000	2%	$3520	96.7

The price, based on real transactions, is estimated using commission rate and product price.

In the percentage fee method, the price change is split into two parts, the change of the percentage fee and the change of the product price. Thus, the price of the service can be estimated by updating the price in the previous period via the following formula:

$$P_s^t = P_s^{t-1} \times \frac{1 + m_t}{1 + m_{t-1}} \times \frac{P_t}{P_{t-1}}$$

Where: P_s^t, is the price of the final service output in period t;

P_t, is the value of a group of contracts, assets or products in period t;

m_t, is the percentage fee in period t that applies to the value.

Capturing price development by applying the above formula is less data demanding than when fees for well-specified products are targeted directly because only the price index for the product group and percentage fee are required. However, the underlying product group should be sufficiently homogeneous over time to provide a valid price estimate.

A special application of the percentage fee method is employed where the pricing mechanism is based on a scale with varying percentages that depend on the value of the underlying product. Typically, the percentage fee decreases according to a schedule as the value of the product increases.[10] In this case, only products in the same fee schedule category can be taken as homogeneous. However, the same product (although not directly observable) might, as a result of more general price inflation, move to a different fee schedule category where a different commission is applied. This scenario should be accounted for in index compilation.

It should also be noted that as a consequence of the assumption that the price of the service is related to the price of the underlying asset or product, any change to the size or quantity of products will be directly reflected as changes in the volume of services.

2.2.5. Component pricing method

The component pricing method individually measures the price movements of all or some output components of the final service output. In other words, the service is divided into a number of key output components of which one or more are then priced separately.

Data type in the survey

For each output component actual respondent data are used. No subjective estimation should be used. Component pricing is fully based on real transaction prices of output components that have been combined to form or estimate a price of the final service output.

The main restriction on this method is that time based prices (such as the price of one hour of work) are not used for determining the price of components. Otherwise the pricing method belongs to time based pricing (see section 2.2.7.). This is due to the fact that often in the production of services, labour accounts for a high proportion of inputs. The importance of this principle is particularly apparent in cases where time based pricing is applied for sub-services that are subject to strong technological development. For example, the adoption of more advanced technology may lead to increased hourly rates but also to a reduction in the required working time. Consequently "real" prices and volumes of services may remain stable. A fixed weight structure, even when updated frequently, does not capture these changes and a biased sub-component price may end up contributing to the final price.[11] On the other hand, assessing required working time rather than keeping it fixed would mean that the method falls into the category of model pricing where (at least some) subjective estimation is made.

The pricing method used in the reporting of each separate output component (*e.g.* real transaction prices, unit value, etc.) should not be considered when determining the overall pricing method used for the "total" price.

Use of the component pricing method

An advantage of component pricing is its flexibility of use. Care should be taken to ensure its representativeness over time and therefore sub-components and weight structures should be updated frequently.

In practice, the price for each individual output sub-component is provided by the respondent and the compiler then combines this information to compute a price index for the composite service. There are different ways of combining or aggregating across the elements for which prices have been collected. Methods include:

- The use of existing bills or contracts to draw up a user profile. For example, a typical bill for a telecommunications client applies different rates for local phone calls, national calls, etc., and the total volume of communication is distributed between these elements (see box 2.8.). Representative distributions of communication volumes constitute user profiles. These user profiles can provide the necessary weighting schemata to construct a composite index of communication services. Sometimes not all elements of composite prices can be covered. Where this is the case, it has to be assumed that the price of the missing element moves approximately in line with the average of the other elements. Omissions may also be acceptable if the user profile shows a very small weight for the missing element;
- The use of output or consumption weights. Composite prices can be constructed by collating prices of components using a weighting schemata provided by the respondent. This kind of pricing can be considered for use in transportation services, for example.

A total price derived during the application of the component pricing method will not necessarily correspond to the price of any transacted service because quantities of sub-

services in the component price may differ from actually transacted services. Furthermore, some sub-services may not be covered even though it is desirable that the coverage of sub-services is as exhaustive as possible.

The component pricing method is not widely used except in telecommunication services (see box 2.8.).

Box 2.8. Component pricing: Telecommunications

Pricing of local telephone services:

(a): Average number per access line (weight) in the base period is obtained by dividing the total number of units for each type of charge by the total number of access lines.

(b): Average revenue per unit in period t is obtained by dividing revenues for each type of charge by the total quantity used of each charge.

(a) × (b): Weighted revenue in period t is calculated by multiplying average number per access line by average revenue per unit.

Type of charge	Average number per access line (a)	Average revenue per unit (b)	Weighted revenue (a) x (b)
Access line	1	26.7530	26.7530
Usage charges based on time:			
Peak minutes	162	0.2589	41.9418
Off-peak minutes	133	0.0824	10.9592
Roaming minutes	10	0.9722	9.7220
Usage charges other than time:			
Landline, per call	2	0.1500	0.3000
Other charges, daily rate	1	1.5000	1.5000
Features/Options and feature packages:			
Custom calling package	0.65	3.4600	2.2490
Call waiting	0.20	4.8500	0.9700
Call forwarding	0.10	5.1500	0.5150
3-way conference	0.05	5.7500	0.2875
No answer transfer	0.10	4.2500	0.4250
Voice messaging	0.20	4.8000	0.9600
Total (Price in period t)		***96.5825***	

The price, based on real transaction of sub-components, is the sum of weighted revenues. The method used is not unit value: unit values are used for the components but it is not unit value pricing method because the various unit values are combined.

2.2.6. Model pricing method

General features of the model pricing method

The model pricing method is the most appropriate approach for use in industries where service outputs are predominantly unique. As the compiler requires in each period a price for a standard service with constant specifications, the method allows for estimation of the price for a standardised final service product, a model transaction which is not transacted in the comparison period. [12]

The model transaction represents a service product that is non-observable (virtual) at the time of data collection. Two types of model transaction can be considered as follows:

1. A model can be a service that has never been observed as such, a fictitious single service that can be set as the re-priceable service product for a group of respondents;
2. Alternatively, a model can be a service that has been directly observed in the past, but not during the current pricing period. In other words, the specifications of a real service provided can be developed as the 'model' to price. For example, an engineering services producer is asked to select a representative contract which it has signed in the past and for each period to quote the required price to undertake that project in the survey period. When selecting a real transaction for use as a model, a recent service transaction is generally selected. A recent transaction may more accurately represent the current activity of a service producer and the price may be updated more easily.

It is important that although model prices are not based on observed market transactions, estimates should capture prices prevailing in the survey period. It is clear that this is the case for small contracts where respondents have recorded data that can be directly used in the estimation of model prices. However, the same principle applies also when a contract covers several periods, that is, estimates for all parts of a project should be made based on conditions and prices prevailing in the survey period. Deviating from this rule would mean that the accrual principle is not followed and this could imply biased measures of service volumes when SPPI are used for deflation.

Noteworthy in the case of contracts that last several periods is the fact that model prices differ from prices of actual tenders where future changes in inflation, taxation etc. might be taken into account. They are artificial in the sense that project costs and mark-ups represent only the market situation in the current survey period although various stages of a long-term project become actual (or current) at different points in time. On the other hand, relying only on present price levels is also an advantage from a practical point of view because there are fewer uncertainties in the estimation of prices and base data used in the estimation may be directly available.

Estimating model prices

Appropriate models for different service industries will have different requirements. It is essential that the model is specified in sufficient detail; so that the respondent reports prices for a constant quality model and that no variation from the model occurs over time without notification to the compiler.

The estimation of a real transaction price is fully based on expert estimation which may be subjective. The expert might consider real transaction prices, revenue and amount sold, list prices and any input data for calculating this price. The resulting total price for the service is therefore a fictitious expert estimate. The pricing method used to form the resulting total price should not be a consideration when determining the overall pricing method.

A central task for the expert is to estimate the working time required to produce a service. An estimation based on the current market situation is needed, for instance by keeping recent tenders in mind. Indeed, pricing factors such as hours worked should be updated in model prices when there is a change in the number of hours required to provide the service. The re-evaluation of the required working time is essential in order to capture changes in the efficiency of service provision. If the working time is not evaluated but assumed unchanged, the method is not categorised as model pricing but as pricing based on working time. In other words, as prices of the same services (although

virtual ones) are followed over time, changes in productivity must be taken into account. In practice, the difference between the methods may not be very significant if respondents cannot accurately describe how much more or less time a service provision requires compared to the previous period.

When estimating the price of the model, the expert should pay particular attention to the following factors: labour costs (staff by skill or experience and numbers of hours); overheads; and gross profit margin (the representative margin that would apply in the current competitive climate). For each pricing period, the respondent will need to "re-cost" each component. Special attention is needed to ensure that the model describes an output with an associated price and not a list of input components and prices.

As noted above, it is particularly important that labour input is adequately re-estimated to reflect changes in productivity. The respondent must therefore detail any change in the number of hours needed for the production of the model described in output terms (for example 1,000 engineer hours were previously required, now only 930 engineer hours are needed). If this detail is not provided, the model pricing method has the same 'productivity problem' as time based methods. Models might also have to be modified from time to time to ensure that they remain representative of the type of outputs of, and production methods used by, the service producer.

The reported profit margin should reflect actual business conditions in the pricing period, and this component is therefore expected to fluctuate with market conditions (for example it will be higher in periods of market growth and lower, perhaps even negative, in periods of recession).

Use of model pricing

Models might be hypothetical and/or based on real transactions from previous periods. Perhaps the most convenient way to implement the method is to rely in so far as possible on actual data from more recent periods. A model could be, for example, based on a contract that was made in a recent period. Use of recent data has a number of advantages, for example:

- Changes in market conditions will be better accounted for;
- Constant quality of service products will most likely be better ensured;
- Representativeness of service products and prices will be better ensured;
- It is easier for respondents to estimate prices. Fresh data will be available to make appropriate adjustments in those cases when some features or characteristics of the service change.

On the whole, compared to a hypothetical or old model, model pricing from the recent period should give better quality results. This may be the case particularly if respondents have not undertaken any work in the recent past and are not tendering for any such work related to the hypothetical model. The type of data that is available for use in developing the base period model might differ depending on the service and service provider. Typically, they include data on charge-out rates applied in service projects and various data on costs. A combination of detailed respondent data from a recent period and similar data in the survey period provides the best possible framework to capture price development.

When using model pricing, the starting point is to select a specific service and adequately specify the details of that service. The respondent is asked to price the same service in t-1 and t rather than assuming from the outset that the required working hours

by staff category alone provides a sufficient transaction specification, as is the case in the hourly rate method (see section 2.2.7.). That means that although price changes mostly stem from changes in hourly rates, overhead and profit, some changes might also originate from changes in the number of working hours and other features.

Specifically, if a different number of hours or a different mix of personnel and their hours are required to provide the exact same service or contract in the survey period, then those factors have to be updated and the resulting changes shown as price changes. Note however that if the resulting price changes are large, then the respondent should be contacted and asked to explain why and to ensure that no changes have been made to the specified service.

Changes to a model might also result from changes in technology or to regulation such that the exact same output is provided with a change in the amount of inputs. In such cases, recording the difference as a price change is fully justified. On the other hand, if it can be concluded that the change in inputs really does result in a change in the output (or the service being provided), then a quality adjustment is required. The information can be used in updating the service description but the price must be adjusted.

Because the respondent is being asked to price the same service in period t-1 and t, the unit of measurement is actually a price movement. This differs from the normal situation where a respondent is asked to provide only a price for each sampled service product for the current period of reference. Therefore, in using this method, the reported price movements collected each period for the model should be linked together to measure the evolution of price.

Note finally that a problem with model pricing is that it can be difficult to ensure that the models employed remain representative. Also, the workload imposed on the respondent is relatively large even in cases when models are based on recently provided service products. This implies a risk that the respondent will not commit sufficient effort to ensuring accurate returns and may instead report model prices that remain unchanged for several periods. Therefore, it is important to engage with respondents to ensure that the prices reflect adequately the evolution of the market situation.

The model pricing method is typically employed for the following industries: freight transport by road, air transport, postal and courier activities, legal activities, accounting, bookkeeping and auditing activities, tax consultancy, management consultancy activities, architectural and engineering activities and related technical consultancy (see box 2.9.), technical testing and analysis, advertising, market research and public opinion polling, software publishing, insurance activities, health service industries and financial service activities (combined with percentage fee).

Box 2.9. Model pricing: Engineering services

Specification of the service: Building related engineering services. Contract identifier: Project BLS-PPI. Billing invoice number: 123. CLIENT #456. Multi-use building. Non-fixed (variable-hourly fee). Qualifications based selection. Monthly billing. Review soils @ excavation base; test engineered fill, backfill, observe concrete reinforcement & masonry construction for compliance; provide proof roll of parking areas; sample & test fresh concrete & compressive strength; masonry grout & prism testing.

Charge Category	Hours	Rate	Hours × Rate
Compaction testing	1	$40.00	$40.00
Special inspections, concrete	15	$50.00	$750.00
Concrete testing	25	$40.00	$1,000.00
Sample pick-up	6	$40.00	$240.00
Special inspections, masonry	8	$50.00	$400.00
Project mgmt. – Senior project engineer	2	$80.00	$160.00
Total fee			**$2,590.00**

Every survey period the respondent estimates the number of hours and rates for each charge category required to provide the fixed service described in the specification. The estimated price is not a price based on working time since the number of hours is not fixed; rather the service being provided is fixed.

2.2.7. Pricing methods based on working time

General features of pricing methods based on time worked

Pricing based on working time differs from other pricing methods in that the price of the service finally provided is not identified but that the price of the time spent in the provision of the service is used instead. Services are assumed to correspond directly or predominantly to different types of chargeable hours worked for a client. The validity of the method depends on how realistic this assumption is; that is the extent to which the quantity and quality of chargeable hours worked remains constant over consecutive periods.

Measurements of prices based on hourly (or charge out) rates represent pricing mechanisms rather than the actual prices of real services. The price of a real service is made up of all payments to the service provider and it is this total price rather than the hourly rate that should, in ideal circumstances, be observed. The degree of appropriateness of time based pricing methods for direct use in SPPI compilation depends largely on the services concerned.

Characteristics of the methods based on prices of working time become apparent when a time based index is used in the deflation of National Accounts. If a price index is assumed to equal the development of hourly rates, the measure of volume corresponds to the time devoted to the service provision (number of worked hours) rather than the volume of services provided. No change in productivity is reflected in these measures except those stemming from changes in the staff structure – productivity development is slightly positive if the share of higher-paid staff goes up and is negative in the reverse case. Productivity change is not picked up within each staff grade.

The assumption of unchanged productivity in each staff grade is particularly strong in a situation where the staffing structure is subject to change. Changes in the staffing

structure often mean that the content (and value) of work changes within grades. For example, with the help of new technology some tasks previously carried out exclusively by professionals may now be delivered by support staff. As a result the volume and quality of the work of support staff and perhaps professional staff change – undermining the assumptions underlying the method. An adjustment procedure is needed because of a quality change to the unit priced, the chargeable hour. It depends on each actual situation and data availability as to how adjustments are made in practice. However, this does not solve the productivity problem which would require that "real" service output should be identified.

The acquisition of, or improvements to, office machinery, software and other equipment are expected to improve real service output and productivity. The time worked to produce services may shorten and the quality of services might change. Thus, SPPIs based solely on time worked for clients, tend to be positively biased, particularly in those service industries greater amounts of equipment are used in production.

Nevertheless, hourly rates represent observable pricing mechanisms and are a natural starting point for the compilation of certain SPPIs.[13] For some services it may be difficult to identify more suitable options than hourly rates. In such cases the resulting SPPI may be accurate in the short term but in the longer term it might be subject to an increasing risk of bias, depending on the type of service. There are very few market services where productivity improvements are not expected over the longer term.

The pricing methods based on worked time are in principle straightforward. Several time based methods can be distinguished and these are briefly discussed in the following sub-sections. They can be broadly classified into two main categories:

1. Methods where the resulting price is fully based on working time required to provide a service;
2. Methods that use a significant element of time based measure as part of the estimation are referred to as predominantly based on prices of working time.

Special attention needs to be paid to the sensitivity of the methods to changes in the scope of *billable working hours*.[14] For example, if support staff is ceased to be charged separately and charge-out rates of professionals increase to account for this, then the resulting price index would increase and in theory the estimate of volume change for the industry would decrease after deflation even though the actual service output is unchanged. Put differently, savings gained by a more efficient use of staff are not reflected in prices but the index becomes upwards biased. A similar example occurs where charge-out rates for professionals increase due to the application of new technology, which allows them to complete tasks quicker thus reducing their billable hours whilst providing the same service to clients.

Thus, when using time based methods, the compiler should be vigilant to potential changes in the coverage of billable hours and, provided that the method is considered applicable in the situation, should adjust for them as appropriate (by excluding changes in charge-out rates which do not result from pure price change).

Compilers could, for example, inquire if a change in hourly rates between the current and previous period has been influenced by factors such as changing technology, administrative reorganisation or changes to billing structures. Resulting adjustments might eliminate some volatility in the index. However in order to make a comprehensive adjustment, the relevant service products have to be explicitly or implicitly identified, in

which case the method would fall into the category of model pricing rather than belonging to time based pricing.

Where business enterprises increasingly outsource their activities the use of hourly rates may not be appropriate. The service purchaser may receive the same service as before but pay a higher hourly rate applied to a reduced number of billable hours. In such cases a deflator based on hourly rates will result in a reduced estimate of the volume of services produced. There is no obvious adjustment procedure for this situation.

2.2.7.1. Resulting price fully based on time worked in the provision of service

The target measure is the price of chargeable working time. In this pricing method the monetary amount charged to a buyer of a service, for a standard amount (*e.g.* one hour) of work by an employee of the producer contributing to the provision of that service is utilised. However, the method has four variants depending on the availability of price data.

2.2.7.2. Hourly charge-out rate

The hourly charge-out rate method represents the simplest case where transaction prices are available by labour categories. However, depending on the type or price data in the survey two variants exist in practice.

First, the resulting price could be estimated as a weighted average of hourly rates. In this case, respondents provide average hourly rates charged, subdivided by type of labour. This data could be taken directly from on-going projects or – more subjectively – they could reflect the respondent's estimate of the general market situation. The overall price change is a weighted average of changes of charged hourly rates in different labour categories:

$$P_t = \frac{\sum_i h_t^i r_t^i}{\sum_i h_t^i};\ P_{t+1} = \frac{\sum_i h_t^i r_{t+1}^i}{\sum_i h_t^i}$$

Where: P_t is the price in period *t*;

r_t^i, is average hourly charge-out rates in staff class *i* in period *t*;

h_t^i, is the number of hours worked in staff category *i* in period *t*.

Box 2.10. shows an example of hourly charge-out rate in engineering activities.

Box 2.10. Pricing based on working time / Hourly charge-out rate: Engineering activities

Respondents report of the average hourly rates of different types of personnel (total rate / total hours worked during the reference period).

Service	Unit	Price		Price change	Weight
		t-1	t		
Machine and process designing					**0.25**
Senior Consultant, Person A	€/hour	54.5	55.21	1.013	
Senior Consultant, Person B	€/hour	54.5	53.52	0.982	
Consultant, Person A	€/hour	45.4	45.24	0.996	
Consultant, Person B	€/hour	43.2	42.1	0.975	
Junior Designer, Person A	€/hour	43.8	42.5	0.970	
	Geometric mean			0.987	
Electrical wiring designing					**0.75**
Designer, Person C	€/item	59	59.2	1.003	
Junior Designer, Person A		54.2	55.2	1.018	
Junior Designer, Person B	€/item	53	56	1.057	
	Geometric mean			1.026	
Weighted change from t-1 to t					**1.016**

The same method is applied for business and management consultancy activities. Respondents usually report hourly-rates (Rate / hours worked) directly from their accounting systems.

A second kind of charge-out rate method uses average hourly rates for staff classes directly in the compilation of an SPPI. The price is derived by dividing revenues for service by number of hours worked.

$$P_t^i = \frac{R_t^i}{h_t^i};\ P_{t+1}^i = \frac{R_{t+1}^i}{h_{t+1}^i}$$

Where*:* P_t^i, is the price in period t;

R_t^i, is the total of revenues in staff category i in period t;

h_t^i, is the number of hours worked for clients in staff category *i* in period t

These kinds of unit rates are called average "realised hourly rates" in the Netherlands and "fee income per grade of worker" in the U.K. (see box 2.11). Note that as with all unit value indices, the homogeneity of the classes is an issue.

Box 2.11. Pricing based on working time / realised hourly rates: Engineering activities

The income in € and the number of hours worked are provided in each period via the survey. From these, the realised hourly rate is calculated as their ratio (for instance, in the top line 147, 991 / 2, 980 = 49.6 € per hour).

After calculating these realised hourly rates for both the base period and the comparison period, an item index is calculated for each item. In the example below, the hourly rate of the experienced drawer in the two periods are €49.6 and €55.4 per hour respectively. The item index for experienced drawer is 55.4 / 49.6 = 1.10

	Based period			Comparison period			Index Base period = 100
	Income (€) (a)	Hours worked (b)	Realized hourly rate (income/hours worked) (a) / (b)	Income (€) (a)	Hours worked (b)	Realized hourly rate (income/hours worked) (a) / (b)	
Experienced drawer	147,991	2,980	49.6	100,200	1,809	55.4	111.7
Consultant-engineer	18,000	226	79.6	22,456	313	71.7	90.1
Designer	163,090	1,624	100.4	120,668	1,050	114.9	114.4
Senior project manager	47,010	471	99.8	50,505	533	94.8	95

2.2.7.2.1. Hourly list rates

When transaction prices of working hours are not available, list prices (also known as standard hourly rates) could be used to derive the price of a service. Business enterprises often compile a list of external commercial hourly rates for different staff grades. These rates can be used in the compilation of an index. The classification of labour might vary between enterprises. On the other hand, some enterprises, particularly small ones, may have individual rates per person that are typically drawn up once per year. Note however that the rates might often serve as a reference rather than as the charging rates actually transacted. If so, adjustments based on the difference between realised and implied revenues are of particular importance.

Prices could be derived as follows when using hourly list rates. Note that as in the case of hourly charge-out rates, the method can also be applied separately for individual staff category (unit rates).

$$P_t = \frac{R_t}{R_t^*} \times \frac{R_t^*}{\sum_i h_t^i} \; ; \; P_{t+1} = \frac{R_{t+1}}{R_{t+1}^*} \times \frac{\sum_i h_t^i r_t^{i^*}}{\sum_i h_t^i}$$

With:

$R_t = \sum_i h_t^i r_t^i$, the total of realised revenues in period t

$R_t^* = \sum_i h_t^i r_t^{i^*}$, the estimated total revenues in period t

Where:

P_t is the price in period t;

h_t^i, is the number of hours worked in staff category i in period t;

r_{t+1}^{i*}, is the average hourly list rate in staff category i in period t+1.

It is of particular importance that the total of realised revenues (R_t) used in the adjustment is consistent with estimated total revenues (R_t^*). This means that data on realised revenues are accrual based rather than cash based.

Meting this requirement is often not possible and consequently the ratio of realised and implied revenues might have to be independently evaluated. In such cases the adjustment ratio to be used is an estimate of the average discount rate. As in the case of normal discounts, there is no need for adjustment if the same discounts are applied in consecutive periods.

Indices compiled, using this method, are closely comparable with those of the hourly rate method. In order for them to agree exactly, the adjustment for discounts should be made and the relative difference between real and list prices should be the same in all categories of labour.

2.2.7.2.2. Wages rates

If charge-out rates are not directly available then data on *hourly wage rates* might be used. Respondents are asked to provide data on wages for, and hours worked for clients by, a number of staff categories. Wage rates must be adjusted to correspond to revenues. This means that wages have to be multiplied by an estimate of the ratio of revenues to wages.[15]

$$P_t = \left(\frac{R}{W}\right)_t \times \frac{\sum_i h_t^i w_t^i}{\sum_i h_t^i} \; ; \; P_t = \left(\frac{R}{W}\right)_{t+1} \times \frac{\sum_i h_t^i w_{t+1}^i}{\sum_i h_t^i}$$

Where:

P_t, is the price in period t;

$\left(\frac{R}{W}\right)_t$, is the revenue/wage ratio in period t;

w_t^i, is the average hourly wage in staff category i in period t;

h_t^i, is the number of hours worked in staff category i in period t;

R_t, is the total of revenues in period t;

The wage rate method is very sensitive to the estimation of the revenue/wage ratio and therefore a strict correspondence between revenues and wages is essential. Revenues should be accrual based to provide comparable prices for consecutive periods. With a high quality ratio, results generated by the wage rate method are closely comparable with results obtained when using the previously described time based methods. The relative accuracy of the methods depends on whether wage- or charge-out rates better reflect the differences in the performance of staff in various categories of labour.

As in the case of hourly charge-out rates and hourly list rates, the method can also be applied separately for individual staff categories (unit rates).

Box 2.12. shows an example of the use of wages rates.

Box 2.12. Pricing based on working time: Wage rates

The wage and the revenue/wage ratio are provided in each period via the survey. If the wages change only twice a year, bi-annual surveying suffices. The revenue/wage ratio (R/W) on the other hand changes faster.

The price is the average wage multiplied by the R/W ratio (third line).

Quarter	1 (base)	2	3	4	5
Wage	40 €	40 €	41 €	41 €	45 €
Revenue/wage ratio (R/W)	2.00	1.90	1.85	1.95	1.90
Price (wage × R/W)	80.0 €	76.0 €	75.9 €	80.0 €	85.5 €
Price index (quarter 1 = 100)	**100.0**	**95.0**	**94.8**	**99.9**	**106.9**

2.2.7.2.3. Working days

Occasionally data on working time are not available on an hourly basis but perhaps in terms of working days. In these cases the compilation procedures are in principle the same as for hourly rates. However, the unit used in the estimation is less precise and this may influence the accuracy of results.

2.2.7.3. Resulting price predominantly based on working time spent in the provision of service

The category of "methods predominantly based on prices of working time spent in the provision of service" describes practices where a price is not directly time based but instead time based measures are used as building blocks in the estimation of price. In other words, the resulting price is not fully measured in terms of a clearly specified service.

Different situations may arise where pricing methods fall into the category of "time based methods" although price evolution of identical and clearly specified service output was initially the target measure:

- Prices are made-up of several sub-components – as defined under the component pricing method (section 2.2.5.) – including compensation for a fixed number of hours of work to produce a given service. The use of time based prices for sub-components that are subject to significant technological development, particularly when their weight in the calculation of the price is high, imply a high risk of bias;
- Price are virtual and thus resemble model pricing (section 2.2.6.) but the working hours underlying the price are always assumed to be the same as in the previous period rather than based on genuine evaluation;
- Prices are estimated using fees that are associated with service projects or contracts (like in percentage fee method, section 2.2.4.) for which price development is measured using a time based-method.

As previously noted, an important aim of the classification of pricing methods is to monitor the characteristics of resulting price indices. Therefore, it is essential to separate

time based methods from those methods under which the price development of identical service transactions is targeted.

2.2.8. Margin pricing method

The margin pricing method is used to measure price development in services that are not separately invoiced and where the service is related to the transformation in space or time of an item. The item may be a product, such as a good purchased and sold by a retailer or a loan provided by a financial intermediary. The price of the service can be estimated as the difference between the price paid by the service provider for the good or service they transformed and the price paid by the final consumer (at the same point in time).[16]

Data type in the survey

There are two distinct types of margin prices: those charged by retailers and wholesalers, in relation to the goods and services they sell, and those charged by financial intermediaries, in relation to the loans and deposits they provide.

In the case of wholesalers and retailers the data sources are acquisition and selling prices for selected items/products or services purchased for resale. The difference between selling and acquisition prices – both real transaction prices – results in a margin price that reflects the actual transaction price of services provided by wholesalers and retailers.

In practice the information will cover a heterogeneous mix of products. Ideally the calculation of margin prices should be based on a product list that is as detailed as possible. Separate price indices should be compiled for individual products and these should be combined by weighting in accordance with the value of sales of the individual products. In this approach, the margin price method splits the price change into two parts, a change in the margin rate (similar to a percentage fee, see section 2.2.4.) and a change in the price of the product sold. Thus, the price of the margin service for a given product can be estimated by updating the price in the previous period via the following formula:

$$P_s^{t,i} = P_s^{t-1,\mathrm{i}} \times \frac{1 + m_{t,i}}{1 + m_{t-1,\mathrm{i}}} \times \frac{P_{t,i}}{P_{t-1,\mathrm{i}}}$$

Where: $P_s^{t,i}$, is the price of the final service output in period t related to the transformation of product i;

$P_{t,i}$, is the value of a homogeneous product (i) sold in period t;

$m_{t,i}$ is the margin rate (the difference between the total value of homogeneous products (i) sold by the retailer/wholesaler and the value it would have to pay at time t as a ratio of the latter).

And so the price index for a group of products sold can be calculated as follows:

$$= \sum_{\mathrm{i}} \quad \frac{\mathrm{p}_s^{\mathrm{t,i}}}{p_s^{t-1,i}} \times \frac{P_{t,i}}{\sum_j P_{t-1,\mathrm{j}}}$$

FISIM

A special case of implicitly priced margin services relates to the measurement of financial intermediation services indirectly measured (FISIM). In layman's terms FISIM

in the *2008 SNA* can be described as the implicit prices charged by a financial intermediary (typically a bank), which take the form of interest rate margins incorporated in the rates charged for loans or paid on deposits. In exchange for paying a higher rate of interest on loans or accepting a lower rate of interest on deposits, customers receive the following types of services: record keeping, safekeeping, payment processing, intermediation between savers and borrowers, risk management and advice, and liquidity provision.

The *2008 SNA* describes FISIM as the following (par. 6.163):

> One traditional way in which financial services are provided is by means of financial intermediation. This is understood to refer to the process whereby a financial institution such as a bank accepts deposits from units wishing to receive interest on funds for which the unit has no immediate use and lends them to other units whose funds are insufficient to meet their needs. The bank thus provides a mechanism to allow the first unit to lend to the second. Each of the two parties pays a fee to the bank for the service provided, the unit lending funds by accepting a rate of interest lower than that paid by the borrower, the difference being the combined fees implicitly charged by the bank to the depositor and to the borrower. From this basic idea the concept emerges of a "reference" rate of interest. The difference between the rate paid to banks by borrowers and the reference rate plus the difference between the reference rate and the rate actually paid to depositors represent charges for financial intermediation services indirectly measured (FISIM).

At the time of writing the Intersecretariat Working Group on National Accounts (ISWGNA) Task Force on FISIM was investigating the definition of FISIM in the SNA. However, this investigation is not expected to have implications for the treatment of FISIM in the context of SPPI compilation, as the research conducted by the Task Force chiefly relates to the definition of the reference rate used in the SNA and the scope and coverage of instruments to which FISIM should be applied. Irrespective of how these issues are resolved, the recommendation on the appropriate price index (as defined below) is unaffected. The Task Force has considered whether quantity approaches to FISIM volume measurement (and so implied deflators for price measurement were possible) but these have been largely ruled out on practical grounds.

The underlying assumption behind FISIM is that there is a specific service provided to borrowers and lenders for which a price can be calculated, based on the interest paid or received on loans or deposits and an underlying reference rate. Currently SNA prescribes the use of a single reference rate for all loans and deposits irrespective of the maturity structure of the loans and deposits. The Task Force on FISIM is investigating what the most appropriate single reference rate should be and also whether specific reference rates are applicable for loans and deposits with different maturities. One other consideration of the Task Force relates to credit default risk and whether this should be removed from the calculation of FISIM (by excluding a component from the interest actually paid by borrowers). What follows therefore is a generic description of FISIM price measurement that assumes credit default risk is already removed from the interest flows. If the Task Force chooses not to remove credit default risk from the value of FISIM, it should be assumed that the interest flows correspondingly include these payments.

At time t, the balance sheets of financial intermediaries show assets of $\sum L_m$, where L_m reflects the value of loans made by the bank with maturity m, with interest of $I_{l,m}$ reflecting the interest received on those loans. The bank also has liabilities of $\sum D_m$ to depositors and pays $I_{d,m}$ to depositors.

Total FISIM in current prices

$$= \sum (I_{l,m} - L_m \times r_m) + \sum (I_{d,m} - D_m \times r_m)$$

Total FISIM in prices of the previous year

$$= \sum (I_{l,m} - L_m \times r_m^{t-1}) + \sum (I_{d,m} - D_m \times r_m^{t-1})/P^t$$

Where:

r_m^{t-1}, is the reference rate in the previous year;

P^t is a general price index (for example the CPI) for year t in relation to year t-1.

The FISIM price index is therefore derived as the quotient of FISIM in current prices and FISIM in constant prices. It is important to note in the above, that even if only one reference rate is used such that r_m is set as r for all m, a breakdown into maturity structures will still be necessary for the calculation of constant price FISIM.

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Notes

1. Pricing methods are here understood as procedures applied in a "normal" situation or routine collection, not in a situation where old services are replaced by new ones and direct adjustments are used to make the service comparable. By convention, even systematically applied, adjustments are out of scope. They do not refer either to initial collection procedures.

2. The index formulae and aggregation methods needed to bring together these basic elements are not discussed in this chapter and reference is made to chapter 3 and the *PPI Manual*.

3. The term is often used interchangeably with "sales" and "turnover". It corresponds to the value of output sold or the value of invoiced sales of goods or services supplied to third parties during the reference period.

4. As mentioned in chapter 1, SPPIs should measure actual transaction prices reflecting revenue received by the producer for services sold to customers. Care must be taken to ensure that the prices reflect those at the time the transaction occurs, and that " […] they must reflect the net prices inclusive of all discounts applied to the transactions whether they be volume discounts, settlement discounts, or competitive price-cutting discounts, which are likely to fluctuate with market conditions. Any rebates also need to be considered. The collection of nominal list prices, or book prices, is not reflective of actual transactions, is unlikely to yield reliable price indices, and may result in quite misleading results because fluctuation in market prices are not captured", *PPI Manual*, par. 1.328.

5. See chapter 1: section 1.1.3. and footnote n°8.

6. "The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer", *2008 SNA*, par. 6.51.a.

7. It does not matter what the unit of 'a service' is; either 'all cleaning under one contract' can be regarded as one service, or a unit of service delivery can be chosen as *e.g.* one trip, one days' cleaning or a week of guarding. Another option, and easiest for practical purposes, is to adhere to what the surveyed price reflects: a price per trip, or per day, or the total price of the monthly or quarterly payment. In the last case, the unit of service can be 'quarterly charge for twice-a-week road transport'.

8. National accountants often directly use quantity indicators, where volume of output is a weighted average of quantity indices based on base year weights. The corresponding price index is the change of output divided by the resulting volume index. The method is used because detailed turnover data might not be currently available to estimate unit value prices. To give satisfactory results, a basic requirement in the method is that quantity indicators cover all output exhaustively.

9. It might also be appropriate to use the Fisher formula in the estimation of price indices for industries undergoing rapid technological changes. This would require that quantity and turnover data are collected continuously to update weights for each period. Weights of firms in the sample become quickly outdated when prices change significantly like in mobile phone and internet services.

10. An example of this is *ad valorem* pricing which is often used in legal services. In this pricing mechanism fees are either based on a proportion of the value of the claim or they relate to price classes which represent the various values of claims. The fee might also change progressively. See section on legal activities.

11. It is recommended to use model pricing in this kind of situation.

12. See also *PPI Manual* par. 6.83.

13. Note that methods based on working time are sometimes also used when the pricing mechanism is not time based for example in the case of *ad valorem* pricing. See section on legal activities.

14. Defined as the numbers of hours used to produce a good or a service billed to the client.

15. This method is sometimes referred to as wages with mark-up or input with mark-up as the mark-up includes administrative and other costs. The term mark-up is not used here to stress that it covers conceptually revenues minus wages. Thus it includes all costs (other than wages) and net operating surplus.

16. See *2008 SNA*, par. 6.146.